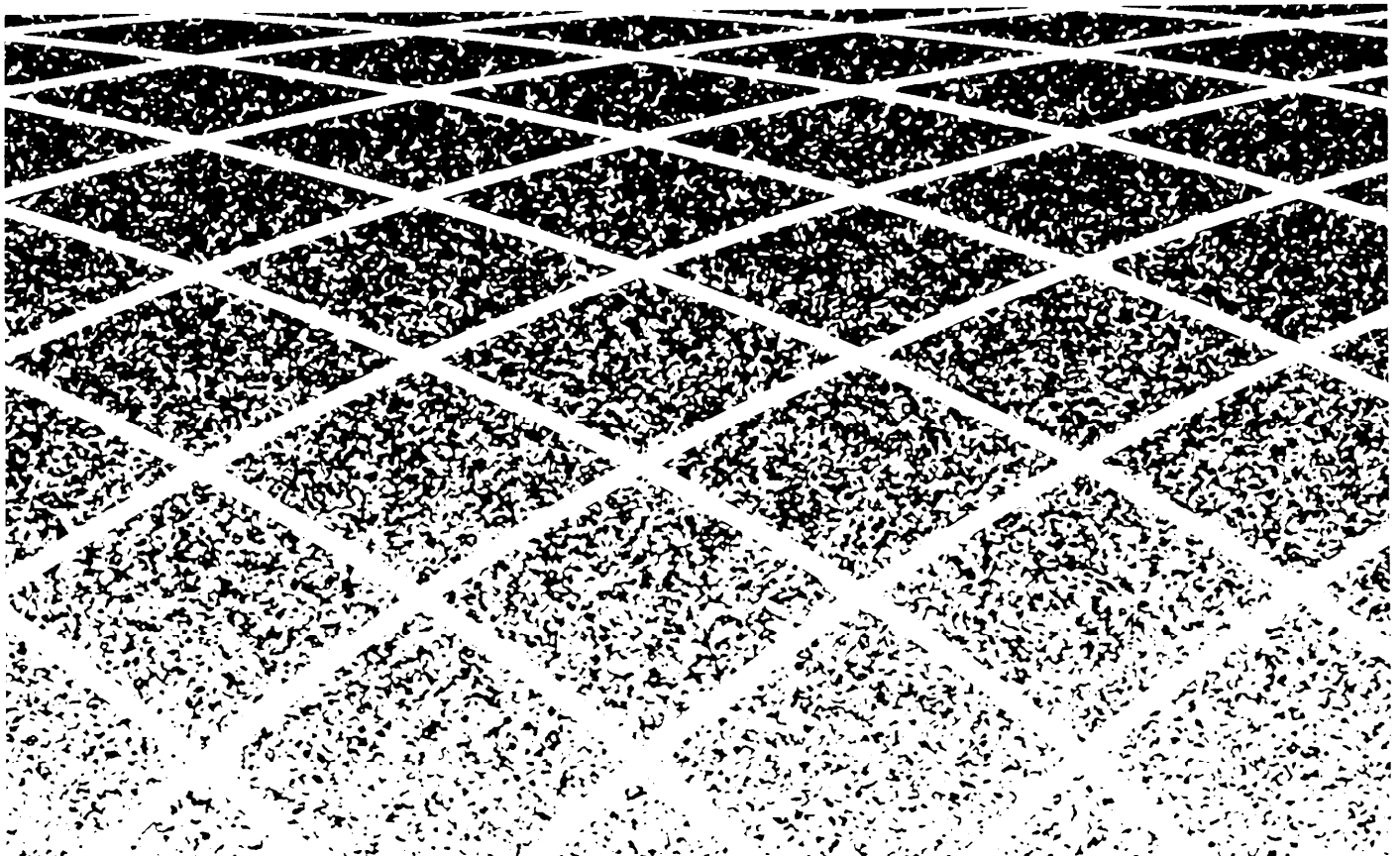




305-920  
Issue 1

# **AT&T Intelligent Ports Card Model 1600 (IPC-1600)**

User's Guide



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## Preface

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## Limited Warranty

AT&T warrants that this product will be free of defects in materials and workmanship on the date of purchase and that AT&T, at its sole option, will repair or replace this product, provided that you report such a defect to AT&T or an AT&T authorized dealer within one (1) year from the date of purchase. If AT&T concludes that the product cannot readily be repaired or replaced, AT&T may accept return of this product and refund your purchase price. Repair parts and replacement products will be furnished on an exchange basis and will be new, remanufactured, or refurbished, at the discretion of AT&T. All replaced parts and products become the property of AT&T. This limited warranty does not include repair of damages to the product resulting from accident, disaster, misuse, abuse, non-AT&T modification of the product, or other events outside AT&T's reasonable control or circumstances not arising under normal operating conditions.

Limited Warranty Service, during the specified warranty period, may be obtained by returning the failed part or the product to an authorized AT&T dealer, or by sending it via mail or carrier to AT&T in accordance with the instructions provided to you by the AT&T Customer Service and providing proof of purchase date. If this product is returned to AT&T, you agree to insure the product or assume risk of loss or damages in transit, to prepay shipping charges to the designated warranty service location and to ship the product in the original shipping container or the equivalent. Contact your authorized AT&T dealer or, if purchased directly from AT&T, your AT&T Account Executive for further information.

All express or implied warranties for this product, including the warranties or merchantability and fitness for a particular purpose, are limited in effect and duration as stated above from the date of purchase, and no warranties, whether express or implied, will apply after this period. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

If this product is not free of defects in material and workmanship as warranted above, your sole remedy shall be repair, replacement, or refund as provided above. In no event will AT&T, its dealers, or its suppliers be liable to you for any damages, including any lost profits, lost savings, or other incidental or consequential damages arising out of the use of or inability to use such a product, even if AT&T or an authorized AT&T dealer or supplier has been advised of the possibility of such damages, or for any claims by any other party. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

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## RF Interference Warning

This equipment has been certified to comply with the limits for an FCC Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules.

All cables used to connect with peripherals must be shielded and grounded for FCC Class B compliance. Operation with cables connected to peripherals which are not shielded and grounded may result in interference to radio and TV reception.

---

# Trademarks

The following trademarks are used in this guide:

- Hayes — Registered trademark of Hayes Microcomputer Products, Incorporated
- HP — Registered trademark of Hewlett-Packard Company
- MS-DOS — Registered trademark of Microsoft Corporation
- UNIX — Registered trademark of AT&T.

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# Ordering Information

Additional copies of this document can be ordered by calling:

Toll free:        1-800-432-6600    In the U.S.A.

                    1-800-255-1242    In Canada

Toll:              1-317-352-8557    Worldwide

OR by writing to:

AT&T Customer Information Center  
Attn: Customer Service Representative  
P.O. Box 19901  
Indianapolis, IN 46219

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# Training Information

The *AT&T Education and Training Catalogue of Courses* and course schedules are free and can be ordered by contacting your account executive or by calling toll free:

1-800-554-6400 (extension 7150)

Training information can also be accessed electronically through our computerized catalogue:

DIAL: 1-800-662-0662 or 1-614-764-5566

LOGIN: comcats

PASSWORD: 88cat



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## Chapter 1: Overview

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# Guide Organization

This guide provides directions on how to install and set up the AT&T Intelligent Ports Card, Model 1600 (IPC-1600). It also explains how the product interacts with other components of your computer system and advises you on troubleshooting.

The remainder of this guide is divided into the following:

- Chapter 2, “MS-DOS\* Device Driver Installation,” describes how to install the MS-DOS device driver software.
- Chapter 3, “UNIX® System Device Driver Installation,” describes how to install the UNIX system device driver software.
- Chapter 4, “Hardware Installation,” provides general information about installing the IPC-1600 board. Refer to the documentation that came with your system for information about installing and removing expansion bus slot boards.
- Chapter 5, “Managing the Serial Ports,” defines the IPC-1600 device node names and describes how to administer (manage) the serial ports using either the **hipcutils**(1) command or the optional AT&T Framed Access Command Environment (FACE) subsystem under the UNIX system.
- Chapter 6, “System Features,” reviews the IPC-1600 system features.
- Chapter 7, “Troubleshooting the Intelligent Ports Card,” describes how to run diagnostic tests supplied on the “Intelligent Ports (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0” diskette. Information on how to use the Intelligent Ports Card with other products and other “Helpful Hints” are also provided in this chapter.

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\* Registered trademark of Microsoft Corporation

- Appendix A, “Hardware Parameter Settings,” provides information about setting the Input/Output (I/O) port address, controller memory starting address, and the Interrupt ReQuest (IRQ) level for the IPC-1600. A sample configuration record is provided for keeping track of installed card parameters and characteristics.
- Appendix B, “Serial Input/Output Device Interface,” provides information about port electrical and physical characteristics. Physical characteristics include descriptions of the modular jacks and plugs used to interface Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE). Compatibility with existing cabling systems is also addressed.
- Appendix C, “AT&T IPC-1600 Ports Cabinet,” provides information about an optional cabinet for mounting two 16-Ports Fanout modules. The cabinet provides wiring guides to facilitate the organized routing of the cables and cable strain relief.
- The Glossary identifies terms used in this guide.
- The Index provides access to the information provided in this guide on a subject basis.

---

## What Is an IPC-1600?

The AT&T Intelligent Ports Card, Model 1600 (IPC-1600) is a sixteen port, intelligent, serial Input/Output (I/O) controller with an 80C186 16-bit microprocessor running at 12.5 MHz. The sixteen RS-232, asynchronous ports are wired to RJ-45 (10-pin) fanout modules via two 80-conductor ribbon cables.

The IPC-1600 operates with the AT&T UNIX System V/386 Release 3.2 and later releases on the following machines:

- AT&T 6386E Work Group System
- AT&T 6386/25 Work Group System
- AT&T 6386E/33 Work Group System
- AT&T 6386E/33 Work Group System Model S.

The IPC-1600 growth kit (COMCODE 405980145) provides the following:

- One AT&T IPC-1600 board (COMCODE 405977729).
- Mounting hardware consisting of a mounting bracket and two 2.25-inch, long-shank screws (COMCODE 406112680).
- One *AT&T Intelligent Ports Card, Model 1600 (IPC-1600) User's Guide*, Select Code 305-920 (COMCODE 105747182).
- One AT&T IPC-1600 to 16-ports fanout cable assembly (COMCODE 405980178) which provides two 7-foot (2 meters) long, 80-conductor cables for connecting an IPC-1600 board to a 16-Ports Fanout module.
- One 16-Ports Fanout module providing sixteen 10-pin RJ-45 type modular connectors (COMCODE 405977869).

**Note:** Separately orderable modular cables and adapters are necessary to connect I/O devices to the serial ports. See Appendix B, "Serial Input/Output Device Interface" for modular cable and adapter information.

- Two diskettes [one 3.5-inch, 720-KB diskette (COMCODE 405977737) and one 5.25-inch, 360-KB diskette (COMCODE 405977752)] each labeled “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0.”
- Two diskettes [one 3.5-inch, 1.44-MB diskette (COMCODE 405977786) and one 5.25-inch, 1.2-MB diskette (COMCODE 405977802)] each labeled “Intelligent Ports Card (IPC-1600) UNIX System V/386 Device Drivers, Version 1.0.”
- Standard insert material:
  - Service Information Card
  - Product Registration Card
  - Warranty Card
  - Read-Notice Card—Multilingual Card
  - Software Limited Warranty Card.

A separately orderable AT&T IPC-1600 Ports Cabinet (COMCODE 405977646) provides mounting space for two 16-Ports Fanout modules. The AT&T IPC-1600 Ports Cabinet can be placed on the floor, a table, or wall-mounted. Refer to Appendix C for additional information about this optional cabinet.

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# IPC-1600 Architecture

The architecture of the IPC-1600 provides many useful and powerful multiuser capabilities under the UNIX system. Furthermore, single-user applications using the IPC-1600 for general-purpose I/O, as well as for industrial control, can be done under MS-DOS.

IPC-1600 features include the following:

- One 80C186 16-bit microprocessor (12.5 MHz).
- Industry Standard Architecture (ISA) bus connectors (any 16- or 32-bit slot can be used).
- One host Interrupt ReQuest (IRQ) level can be shared per 16 ports or one IRQ level can be assigned for all IPC-1600s (maximum of 7 boards [112 ports]).
- A 64-KB dual-ported Static Random Access Memory (SRAM) is used for data storage and buffering. This SRAM provides communications and control between the host processor and the IPC-1600 microprocessor. The host processor address range for this space is on 64KB boundaries and is switch selectable. This SRAM is “zero-wait-state” to the IPC-1600 microprocessor.
- A 16KB RAM for local programs.
- The use of a 16-bit data transfer on the Industry Standard Architecture (ISA) bus for maximum efficiency.

Chapter 6, “System Features,” provides more detailed information.

---

## Ports and Drivers

The software that takes care of the I/O tasks between the user terminals/MODEMs/printers and the UNIX system is built into the IPC-1600 firmware to increase the UNIX system performance. End users get the benefit of immediate keyboard/screen response and the enhancement of the overall performance of the UNIX system. The UNIX system driver supports the 8-bit character set.

The MS-DOS device driver supports an 8-bit character set and the MS-DOS level interface.

---

## Information in the Examples

The contents of most of the displays presented in this guide depend on the particular machine configuration. Therefore, the information displayed on your terminal will vary from the information presented in the examples. In particular, the installation software displays and display options are dynamic with respect to available system configuration resources. All displays in this guide were taken from an AT&T 6386E Work Group System (WGS).

The following notation scheme is used to show examples of terminal input and output.

- Text you enter on your terminal is shown in **bold** type.
- Text displayed on your terminal by the computer is shown in `constant width type`.
- Comments and explanations in displays are shown in *italic* type to separate them from the text representing computer input or output.



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# Hexadecimal Notation

Throughout this guide, base 16 numbers (hexadecimal) are denoted by a lowercase letter “h” suffix. For example, 100h.

---

# MS-DOS and UNIX System IPC-1600 Use Strategy

## Native MS-DOS and UNIX System Operation

**Requirement:** The host computer must be set up to have base memory above 512KB (512KB to 640KB) disabled for the IPC-1600 to use controller memory starting addresses 080000h or 090000h. Refer to the customer documentation that came with your AT&T Work Group System (WGS) for information on how to disable base memory.

If you plan to use both the native (boot) MS-DOS and the UNIX system for the operation of the IPC-1600, proceed as follows.

1. Follow Chapter 3, “UNIX System Device Driver Installation,” procedures with the following recommendations.
  - ❑ Install the IPC-1600 board(s) using controller memory address space below 1MB.
  - ❑ Configure multiple IPC-1600 boards to share one Interrupt ReQuest (IRQ) level and share the same 64-KB controller memory address space.
2. After installing hardware (Chapter 4), install MS-DOS software starting with Step 3 in Chapter 2. Be sure to specify same controller memory starting address and I/O address(es) that were set when installing the UNIX system device driver and IPC-1600 hardware.

## MS-DOS Under Simul-Task and UNIX System Operation

If you plan to use MS-DOS under Simul-Task 386 or to use only the UNIX system for the operation of the IPC-1600, skip Chapter 2. Start with Chapter 3, “UNIX System Device Driver Installation,” and follow the instructions for the installation of the software. Then install the IPC-1600 board per Chapter 4, “Hardware Installation.”

## Native MS-DOS Operation

If you plan to use only native MS-DOS for the operation of the IPC-1600s, start with Chapter 2, “MS-DOS Device Driver Installation,” and follow the instructions for the installation of the software and hardware. Skip Chapter 3.

---

## Chapter 2: MS-DOS Device Driver Installation

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# Introduction

**Comment:** If you are using only the UNIX system for Intelligent Ports Card operation, you can skip this chapter and go to Chapter 3, “UNIX System Device Driver Installation.” If you plan to use MS-DOS under Simul-Task 386, follow the procedures in Chapter 3. The instructions in this chapter apply only to native MS-DOS. See the section, “IPC-1600 Diagnostics,” in Chapter 7 for diagnostics information.

This chapter provides instructions on how to install the MS-DOS device driver and diagnostics, which are on the diskette labeled “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0.” Refer to Chapter 6, “System Features,” for information about the software support offered through the MS-DOS device driver.

**Note:** The same software is supplied on both a 5.25-inch diskette and a 3.5-inch diskette.

The Intelligent Ports Card MS-DOS device driver supports the MS-DOS level interfaces in such a way that virtually any software application can access all serial I/O ports provided by the IPC-1600.

**Requirement 1:** The IPC-1600 board(s) must be installed and the I/O address, starting controller memory address, and IRQ level initially set before executing the IPC16CNF program.

**Requirement 2:** Each board in the system must be assigned an I/O address and the same starting controller memory address. The hardware Interrupt ReQuest (IRQ) level switches are all set to OFF unless the UNIX system is also being used to operate the board, in which case the UNIX system switch setup takes precedence. If you assign different controller memory addresses to IPC-1600s, only one board at a time can be used under native MS-DOS.

---

# Installation Procedure

The following steps define the sequence of events for installing the IPC-1600 for use in the native MS-DOS environment. Read the entire procedure and supporting paragraphs before doing the installation. Write down the hardware parameter settings for each board to be installed as you read through the procedure the first time. Then refer to these notes when you do the procedure.

- Step 1: Preconfigure the IPC-1600 boards by setting the DIP switches for a unique I/O address, a starting controller memory address, and IRQ level.
- Step 2: Install the hardware (IPC-1600 boards) using the instructions in Chapter 4, "Hardware Installation."
- Step 3: Power up the system and load the files on the "Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0" diskette.
- Step 4: Create or edit the *CONFIG.SYS* file using an editor such as **EDLIN** to include the `DEVICE=\IPC\IPC16DOS.SYS` entry.
- Step 5: Execute the **IPC16CNF** program to configure the IPC-1600 and configure the driver.
- Step 6: Reconfigure the IPC-1600 DIP switches if necessary to match the software assignments.
- Step 7: Reboot the machine to install the driver.

The following paragraphs provide more information for each of the installation steps. Note that Steps 5 through 7 can be executed when necessary to reconfigure the driver and/or port characteristics.

## Preconfigure the IPC-1600 Boards

Set the starting controller memory address (DS1, SW8—1), the I/O address (DS1, SW11—9), and the IRQ level (DS2, SW8—1) for each IPC-1600 to be installed. Note that IRQ levels are not used by the MS-DOS driver. Therefore all DS2 switches should be set to the OFF position (Note 2). Refer to Appendix A, “Hardware Parameter Settings,” for switch location and decode information.

The following table identifies the initial options. The driver default addresses are shown in bold type face.

Hardware Preconfiguration Options		
Memory Address	Input/Output Address	Interrupt Request
<b>80000h</b>	<b>100h</b>	Set all switches to OFF (Note 2)
90000h	110h	
A0000h	120h	
B0000h	200h	
C0000h	220h	
D0000h	300h	
E0000h	320h	

**Note 1:** The switches on the IPC-1600 board can be easily changed with the board installed in the host system. All IPC-1600 boards must be set to the same memory address.

**Note 2:** If the board is set up for the UNIX system, all IRQ switches do not have to be set to the OFF position to use the IPC-1600 in MS-DOS. The UNIX system IRQ switch settings take precedence.

**Note 3:** The IPC-1600 (16-bit transfer board) cannot share a 128-KB memory address space with 8-bit transfer boards like a hard disk controller board or a video display board.

## Install the Hardware

Refer to Chapter 4, “Hardware Installation,” and follow the instructions for the installation of the board. Ignore any instructions in Chapter 4 involving the DS1 and DS2 DIP switches, since they have already been done in this procedure.

## Load the Software

Power up the system [AT&T Work Group System (WGC) computer] to boot native MS-DOS (Version 3.0 or later) from either the floppy diskette or the system disk drive.

Insert the MS-DOS device driver diskette into the appropriate diskette drive and close the diskette drive door.

Use the MS-DOS **COPY** command to copy all files from the diskette to the system disk. It is recommended that you create a separate directory for the IPC-1600 files as shown in the following examples. Note that system prompts are machine dependent.

As shown in the following screen display, first, shift from the “A” drive to the “C” (system disk) drive and create a directory named *IPC* as follows.

---

```
A: $ C :  
C: $ mkdir ipc  
C: $
```



Now, change directory (**cd**) to *IPC* and copy the files on the diskette in the “A” drive or in the “B” drive to the system disk drive as follows. The example uses the “A” diskette drive; the system disk is the “C” drive.

*Change directory to an optional separate directory to contain the IPC-1600 software.*

```
C: $ cd ipc
```

*Copy the files from the “A” drive to the “C” drive*

```
C:\IPC $ copy a:*. * /v
A:IPC16CNF.EXE
A:IPC16DOS.SYS
A:IPC16DIA.COM
          3 File(s) copied

C:\IPC $
```

Remove the “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Dagnostics, Version 1.0” diskette from the diskette drive and properly store the diskette.

There are two files on the “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0” diskette concerned with the installation of the MS-DOS driver:

*IPC16CNF.EXE*    Use this command to configure the Intelligent Ports Card driver characteristics.

*IPC16DOS.SYS*    MS-DOS device driver for the IPC-1600.

The *IPC16DIA.COM* file provided on the MS-DOS diskette is the IPC-1600 diagnostics. Diagnostics are described in Chapter 7.

## Create or Modify the *CONFIG.SYS* File

Use an editor, such as **EDLIN**, to change (or create) the *CONFIG.SYS* file in the root directory of the drive from which you boot MS-DOS.

Add the following line to the *CONFIG.SYS* file if the *IPC16DOS.SYS* file is in a separate directory. The complete path name must be specified for the **DEVICE** entry. For example, if the driver is in the a directory path *\IPC*, the *CONFIG.SYS* file entry is as follows.

---

```
DEVICE=\IPC\IPC16DOS.SYS
```

Add the following line to the *CONFIG.SYS* file if the IPC-1600 driver (*IPC16DOS.SYS* file) is in the root directory.

---

```
DEVICE=IPC16DOS.SYS
```

## Execute IPC16CNF to Configure the Driver

The **IPC16CNF.EXE** program is used to configure or reconfigured the IPC-1600 MS-DOS driver and to specify individual channel (port) parameters. The following screen shows the initial **IPC16CNF** program display.

IPC1600 CONFIGURATION PARAMETERS					
Board #	Memory Window	Driver Support	Start Chanl	#Brd Chnls	I/O Port
1	080000	DOS	4	16	0100
2	080000	DOS	20	16	0110
3	080000	DOS	36	16	0120
4	080000	DOS	52	16	0200
5	080000	DOS	68	16	0220
6	080000	DOS	84	16	0300
7	080000	DOS	100	16	0320

N)umber of Brds	M)emory Segment	D)river Support	S)tart Channel #
P)ort Address	C)hnl Params	Q)uit	

Select Configuration Option:

Each of the options shown on this initial screen display is described in the following paragraphs.

## Number of Boards Option

The N)umber of Brds option is used to specify the number of installed IPC-1600 boards. The default is seven boards. Once specified, the initial table is redrawn to show the number selected.

## Memory Segment Option

The M)emory Segment option is used to specify the controller memory starting address for all IPC-1600 boards. When selected, the table is redrawn to show the new data. Remember that if all IPC-1600s are to be usable under native MS-DOS, all boards must have the same memory address. Select "8" to specify the default address 080000h.

The following screen display shows the available memory address options.

```
Memory Window Segment
8) 80000h   9)90000h   A) A0000h   B)B0000h   C) C0000h   D) D0000h   E)E0000h

Select Configuration Option:
```

## Driver Support Option

The D)river Support Option is used to specify DOS or INT 14 support. The default is DOS support. INT 14 support is provided for experienced users.

Selecting DOS support assigns and uses names for the individual communications ports so that they can be accessed from DOS and high level languages. The ports can also be accessed through INT 14h calls.

Selecting INT 14 support deactivates the DOS capability of assigning and using names for the installed communications ports. This allows the channels to be accessed only through INT 14h calls. If DOS support is not desired, selecting this option decreases the size of the driver.

The following screen display shows how to select these options.

```
Driver Support      D)OS      I)NT 14

Select Configuration Option:
```

## Start Channel Number Option

The S)tart Channel # option is used to specify the beginning channel number for all IPC-1600 provided ports. Each IPC-1600 port in the system is assigned a number that distinguishes it from the other ports in the system. These channel numbers are used by the driver and INT 14h calls. Selecting the starting channel number specifies the range of numbers the communications ports will use. The standard MS-DOS COM1 and COM2 ports use channel numbers 0 and 1. The default starting channel number for the first IPC-1600 port is 4.

The following screen display shows how to specify the starting channel number.

```
Starting Channel Number for Board 1, Channel 0
```

```
Select Starting Channel # (0 - 255) :
```

## Port Address Option

The P)ort Address option is used to specify the I/O address for the board to the driver. The DS1, SW11—9 must be set to match the address specified to the driver. The following screen display shows the available address.

```
Board I/O Port Options:  100  110  120  200  220  300  320
```

```
Select I/O Port Number:
```

## Channel Parameters Option

The following screen shows the initial display for changing parameters for a given IPC-1600 board. The display shows the default parameters. After selecting a channel, options are presented for changing the ENABLE, BAUD, MODE, HANDSHAKE, and NAME parameters. The display is automatically updated to show what channel has been selected and to show the parameter data.

BOARD 1 PARAMETERS					
CHANL	ENABLE	BAUD	MODE	HANDSHAKE	NAME
4	DSBL	9600	N,8,1	NONE	COM5
5	DSBL	9600	N,8,1	NONE	COM6
6	DSBL	9600	N,8,1	NONE	COM7
7	DSBL	9600	N,8,1	NONE	COM8
8	DSBL	9600	N,8,1	NONE	COM9
9	DSBL	9600	N,8,1	NONE	COM10
10	DSBL	9600	N,8,1	NONE	COM11
11	DSBL	9600	N,8,1	NONE	COM12
12	DSBL	9600	N,8,1	NONE	COM13
13	DSBL	9600	N,8,1	NONE	COM14
14	DSBL	9600	N,8,1	NONE	COM15
15	DSBL	9600	N,8,1	NONE	COM16
16	DSBL	9600	N,8,1	NONE	COM17
17	DSBL	9600	N,8,1	NONE	COM18
18	DSBL	9600	N,8,1	NONE	COM19
19	DSBL	9600	N,8,1	NONE	COM20

Select Channel (#/Q) :

After selecting a channel, the following options are available.

```
Q)uit  E)nable  B)aud  M)ode  H)andshake  N)ame  C)hange  Chanl #
Select Parameter:
```

The E)nable option is used to enable (ENBL) or disable (DSBL) the selected channel (port) as shown in the following screen display.

```

                                     A) DSBL      B) ENBL
Select Settings:
```

The B)aud option is used to set the BAUD rate for the selected channel (port) as shown in the following screen display.

```

      A)   50  B)   75  C)  110  D)134.5  E)   150  F)   200
      G)  300  H)   600  I) 1200  J)  1800  K) 2000  L)  2400
      M) 3600  N)  4800  O) 7200  P) 9600  Q)19200  R)38400

Select Baud Rate:
```

The M)ode option is used to set the parity, word size, and number of stop bits, respectively. Parity can be none (N), odd (O), or even (E). The word size can be 5, 6, 7, or 8 bits. The number of stop bits is 1 or 2. The following screen display shows how these options are selected.

```

      A) N,5,1  B) N,6,1  C) N,7,1  D) N,8,1  E) N,5,2  F) N,6,2
      G) N,7,2  H) N,8,2  I) O,5,1  J) O,6,1  K) O,7,1  L) O,8,1
      M) O,5,2  N) O,6,2  O) O,7,2  P) O,8,2  Q) E,5,1  R) E,6,1
      S) E,7,1  T) E,8,1  U) E,5,2  V) E,6,2  W) E,7,2  X) E,8,2

Select Mode:
```

The H)andshake option is used to select the flow control for the selected channel (port). The following screen display shows how to select the flow control options.

```

                A) NONE      B) XON/XOFF    C) RTS/CTS    D) BOTH
Select Handshake Protocol:
    
```

The N)ame option is used to change the MS-DOS name assigned to the channel. No name is used if INT 14 support has been selected. The following screen display shows how to specify a new channel name.

```

Old Name : COM5          New Name (8 characters max.) :
    
```

The C)hange Chnl# option is used to select the target channel for the other options in this group.



## Finishing Up

Quitting the **IPC16CNF** program using the **Q**uit option produces various messages depending on what has been done before the exit request. During the exit process, a combination of the following prompts can be displayed.

Re-Configure the IPC1600(s) (Y/\*) :

Responding “Y” to this prompt causes the IPC-1600 to be reprogrammed. The system can then be used without a reboot. However, on the next reboot, the system will revert to the previous configuration unless the changes are saved to the system disk.

Save Changes to Disk for Re-Boot? (Y/\*) :

Responding “Y” to this prompt changes the *IPC16DOS.SYS* file on the system disk to reflect the new configuration data. The new configuration is installed by rebooting the system. If the previous prompt was to “Re-Configure the IPC1600(s)” and the response was “Y”, the changes are currently in effect. However, on the next reboot, the system will revert to the previous configuration unless the changes are saved to the system disk.

Quit? (Q/\*) :

Responding “Q” to this prompt terminates the program returns to MS-DOS.

The following screen display shows the typical prompts after changing the IPC-1600 configuration options and quitting for the initial installation.

```
Save Changes to Disk for Re-Boot? (Y/*) : Y
Quit? (Q/*) : Q
Re-boot to Load Driver
```

## Reconfigure the Boards If Necessary

**Requirement:** Be sure to take notes throughout this phase of installation. Write down I/O addresses and the memory addresses so that once the device drivers have been installed you will have a permanent record to which you may later refer. Likewise, if you are going to remove or add a board, write down any changes that you make in the process. A sample configuration record is shown in Appendix A.

Refer to Appendix A, "Hardware Parameter Settings," for switch location and decode information if it is necessary to change these settings to match the software (driver) configuration established by the **IPC16CNF** program. Note that Steps 5 through 7 (this discussion is Step 6) can be executed when necessary to reconfigure the driver and/or port characteristics. The following screen display shows the typical prompts associated with reconfiguration.

```
Re-Configure the IPC1600(s) (Y/*) : Y
Save Changes to Disk for Re-Boot? (Y/*) : Y
Quit? (Q/*) : Q
Re-boot to Load Driver
```

## Reboot the System

Reboot the system (AT&T WGS computer) to load the Intelligent Ports Card MS-DOS device driver.

---

## Accessing Serial Ports

After you have completed the hardware phase of the installation and the configured driver is loaded, use the serial I/O ports on the IPC-1600 as if they were files with file names **COM5** through **COM20** ..., as applicable.

---

## Removing the MS-DOS Device Driver

To remove the Intelligent Ports Card MS-DOS device driver from the system, use an editor, such as **EDLIN**, to delete the entry in the *CONFIG.SYS* file which corresponds to `DEVICE=\IPC\IPC16DOC.SYS`. Then reboot the system.

If you want to free the system disk space occupied by the IPC-1600 software, delete (**DEL**) the *IPC16DOS.SYS*, *IPC16CNF.EXE*, and *IPC16DIA.COM* files along with the *IPC* directory (**RMDIR**). Note, you may want to keep the **IPC16DIA** program if you expect to run diagnostics from the system disk.

The following screen display shows how to delete (**DEL**) all files under the *IPC* directory and then remove the directory (**RMDIR**).

*Removes all files under the IPC directory.*

```
C:\ > del ipc
```

```
Are you sure (Y/N)? y
```

```
C:\ > rmdir ipc
```

```
C:\ >
```

*After editing the CONFIG.SYS file,  
reboot the system to reconfigure the system.*

The following screen display shows how to remove only IPC-1600 driver and configuration software files from the system disk. The **IPC16DIA** diagnostic program remains on the system disk.

```
C:\ $ del ipc\ipc16dos.sys
```

```
C:\ $ del ipc\ipc16conf.exe
```

```
C:\ $
```

*After editing the CONFIG.SYS file,  
reboot the system to reconfigure the system.*

---

## Limitations of the IPC-1600 MS-DOS Device Driver

All IPC-1600 boards in the system must be assigned the same starting controller memory address; otherwise, only one board can be accessed under native MS-DOS. All IPC-1600s can be diagnosed regardless of controller memory address assignments; however, the controller memory address switch settings must be below 1MB.

This MS-DOS device driver will NOT drive the following:

- Any indigenous serial I/O ports such as **COM1:** and **COM2:**.
- The indigenous parallel printer ports **LPT1:** and **LPT2:**.

The built-in MS-DOS RS-232C and printer device drivers can coexist with the Intelligent Ports Card MS-DOS device driver to provide services on the indigenous ports.

Any application software that bypasses all MS-DOS device drivers and controls the hardware directly will NOT work with an Intelligent Ports Card and its MS-DOS device driver. However, those applications which bypass the high-level MS-DOS interfaces and use INT 14 interfaces will work.

In the native MS-DOS environment, the recommended machine-to-machine file transfer command is as follows:

**COPY filename /B COM<sub>x</sub> / B**

such that the entire file is transferred including the execution of the **CTRL Z** keystroke sequence.

---

## Chapter 3: UNIX System Device Driver Installation

---

# Introduction

**Comment:** If you are using only native MS-DOS for IPC-1600 operation, you can skip this chapter. Chapter 2, “MS-DOS Device Driver Installation,” provides MS-DOS driver installation and setup instructions. If you intend to run MS-DOS under Simul-Task 386, use the installation instruction in this chapter.

This chapter provides instructions for installing the IPC-1600 UNIX system device driver, which is on the diskette labeled “Intelligent Ports Card (IPC-1600) UNIX System V/386 Device Drivers, Version 1.0.” This chapter also provides software-related information about removing a board and installing additional boards.

**Note:** The same software is provided on both a 5.25-inch diskette and a 3.5-inch diskette.

It is strongly recommended that you install the device driver before you install the hardware.

**Requirement 1:** Certain system tunable parameters should be adjusted to obtain proper system performance. Also, sufficient system memory must be available to support the number of boards being installed. Refer to the “Tunable Parameters and Memory Requirements” section of this chapter for more information. It is recommended that the tunable parameters be adjusted before installing the IPC-1600 UNIX system software to avoid having to do a separate *idbuild* process.

**Requirement 2:** Be sure to take notes throughout this phase of installation. Write down the Interrupt ReQuest (IRQ) assignment(s), I/O address(es), and the controller memory address(es) so that once the device driver has been installed you will have a permanent record to which you may refer when you install the hardware. Likewise, if you are going to remove or add a board, write down any changes that you make in the process. A sample configuration record is shown in Appendix A.



---

# Tunable Parameters and Memory Guidelines

The following table shows the tunable parameter guidelines for IPC-1600.

IPC-1600 TUNABLE PARAMETERS				
PARAMETER	SYSTEM MEMORY			
	2MB	4MB	8MB	16 MB+
NCLIST	120	170	560	1180
NPROC	100	150	200	400
NREGION	210	300	600	1200

The installation of the IPC-1600 UNIX system driver and related software is independent of these requirements. However, to obtain proper system performance, these parameters should be adjusted before the installation of the IPC-1600. Refer to the *UNIX System V/ 386 Operations/System Administration Guide* for additional information and procedures on setting tunable parameters. By adjusting these parameters and then installing the IPC-1600 UNIX system software, only one system reboot is necessary to install both the new tunable parameter data and the IPC-1600 data.

Failure to adjust these parameters may result in table overflow warning messages and poor performance.

Sufficient system memory must be available to support the number of IPC-1600 boards being installed. The following system memory guidelines should be followed.

IPC-1600 SYSTEM MEMORY GUIDELINES	
NUMBER OF IPC-1600s	MINIMUM SYSTEM MEMORY
1	2MB
2 OR 3	4MB
4	8MB
5 TO 7	16MB

---

# General Installation Procedures

Power up the AT&T WGS computer, making sure that no diskette is in the diskette drive(s) during the boot phase. Wait until the UNIX system is ready, and then log in using either “root” or the privileged access user administration login you have been assigned.

Insert the “Intelligent Ports Card (IPC-1600) UNIX System V/386 Device Drivers, Version 1.0” diskette into the appropriate diskette drive (5.25-inch or 3.5-inch drive) and close the diskette drive door.

At the UNIX system prompt, enter the following:

**installpkg**

Press the **ENTER** key. This invokes the UNIX system software package installation program, which allows you to install the IPC-1600 UNIX system serial I/O driver.

More information about using the **installpkg** command is given in the *UNIX System V/386 Operations/System Administration Guide*.

**Note 1:** Each IPC-1600 board in the system must be assigned a unique I/O address, a controller memory address range, and a hardware Interrupt ReQuest (IRQ) level which do not conflict with any other board types in the system. All IPC-1600 boards in a system must be set up to support ONE of the following conditions:

1. Share controller memory and share one IRQ level (preferred condition)
2. Share controller memory and have unique IRQ levels
3. Unique controller memory address assignments and share one IRQ level
4. Unique controller memory address assignments and unique IRQ levels.

**Note 2:** The use of 080000h or 090000h as the controller memory starting address requires that the base memory above 512KB (512KB to 640KB) be disabled.

---

## Installation Procedures

**Comment 1:** The installation software displays are dynamic and depend on the type and configuration of the machine. All possibilities are not presented in the examples.

**Comment 2:** AT&T Framed Access Command Environment (FACE) subsystem is an optionally orderable product. If available, the AT&T FACE software should be installed before installing the IPC-1600 software.

### Specify the Type of Installation

At the start of the installation process, you may be asked to specify what is to be installed. The following screen shows the installation options with AT&T FACE subsystem already installed.

Please select the type of installation from the list below:

1. Install device driver only.
2. Install device driver and FACE administration menus.
3. Quit

Type:

Enter the number corresponding to the action you want to specify. After you specify either item 1 or 2, you will be asked to confirm your choice. Specifying item 3 terminates the installation process with nothing being installed.

Select option 2 to install the device driver and the AT&T FACE menus for the IPC-1600.

The installation process searches the system data for available:

- Interrupt ReQuest (IRQ) levels
- Starting I/O addresses
- Starting controller memory addresses.

## Specify Shared or Board-Unique Hardware Interrupt Assignment

The installation process then asks you to specify how hardware interrupts are to be assigned.

The IPC-1600, Intelligent Ports Card - Version 1.0 package allows the ports boards to be configured to all use the same interrupt (shared) or for each board to be configured to a different interrupt. If interrupts are shared, a maximum of 7 ports boards may be installed. If each board is configured to a different interrupt, then at most 5 can be installed.

Do you want to share interrupts among all boards? (y or n)

If you specify to share an interrupt level among all boards, you are then asked to select the interrupt to be used by all IPC-1600 boards as follows.

The device driver used for IPC-1600, Intelligent Ports Card - Version 1.0 allows all the boards installed to be strapped to the same interrupt. Please select the interrupt that will be used from the list below. The available interrupt(s) for the ports boards are:

- IRQ 3
- IRQ 5
- IRQ 10 (default)
- IRQ 11
- IRQ 12

Type the interrupt number and strike the ENTER key or type Q to cancel installation. Striking the ENTER alone will select the default.

Enter Interrupt:

## Specify Shared or Board-Unique Controller Memory Assignment

The installation process then asks you to specify how controller memory is to be assigned.

The IPC-1600, Intelligent Ports Card - Version 1.0 package allows the ports boards to be configured to all use the same controller memory (shared) or for each board to be configured to a different controller memory starting address.

Do you want to share controller memory address among all boards? (y or n)

If you specify to share controller memory among all boards, you are then asked to select the controller memory starting address to be used by all IPC-1600 boards as follows. The IPC-1600 comes from the factory with the controller memory address range set to 080000h-08FFFFh. Remember to select a controller memory address range which does not conflict with other board types in the system.

The device driver used for IPC-1600, Intelligent Ports Card - Version 1.0 allows all the boards installed be strapped to the same controller memory address. Please select the controller memory address that will be used from the list below. The available controller memory address(es) for the ports boards are:

Starting Memory address(s):

080000	(default)	090000	100000
180000		200000	280000
300000		380000	400000
480000		500000	580000
600000		680000	700000
780000		800000	880000
900000		980000	A00000
A80000		B00000	B80000
C00000		C80000	D00000
D80000		E00000	E80000
F00000		F80000	

Type the starting controller memory address and strike the ENTER key or type Q to cancel installation. Striking the ENTER alone will select the default:



## Specify the Number of Boards

You are then asked to specify the number of boards to be installed as follows. Remember that the number of boards indicated in the example is dynamic with respect to the system type and available system configuration resources.

The current system configuration will allow for up to 7  
IPC-1600 controller boards to be installed. How many IPC-1600  
controller boards will you be installing?  
(1-7, Q to quit)

Enter the number of boards that you are installing; remember to note this number so that when you install the hardware you will be able to refer to this record. Press the **ENTER** key after typing the number of boards.

For each board, you will be asked to specify the following sequence of information:

- Hardware Interrupt ReQuest (IRQ) level
- Starting I/O address
- Starting controller memory address.

After you specify these three items of data, you will be asked to confirm your choices for the board. If you specified to share an interrupt level among all IPC-1600 boards, the IRQ question is omitted from the loop. If you specified to share the controller memory address among all IPC-1600 boards, the starting controller memory address question is omitted from the loop.

## Assigning Board-Unique Hardware Interrupt Request Level

If you specified board-unique hardware interrupt assignments, the system now displays a list of available hardware interrupts and prompts you to enter the interrupt number to be assigned to the first board that you wish to install. At the factory the hardware is set to IRQ10; if IRQ10 is already assigned, the first available interrupt in the displayed list appears as the default. The hardware IRQ setting(s) will be set in Chapter 4 to match the IRQ assignment(s) made in this chapter.

The following is an example of how the display and prompt may appear on your screen:

```
Please enter the following system configuration information for IPC-1600
Board 1. The available interrupt(s) for the IPC-1600 Board 1 are:
```

```
IRQ 3
IRQ 5
IRQ 10 (default)
IRQ 11
IRQ 12
```

```
Type the interrupt number and strike the ENTER key or type
Q to cancel installation. Striking the ENTER alone will
select the default.
```

```
Enter Interrupt:
```

Either press the **ENTER** key (to enter the default) or type in the name of the interrupt that you wish to assign and then press **ENTER**.

Again, write down the IRQ settings so that you may refer to your records during the hardware installation.

## Assigning an I/O Address

The system now displays a list of available I/O addresses and prompts you to enter the I/O address to be assigned to the board. The IPC-1600 comes from the factory with the I/O address set to 100h; if I/O address 100h is already assigned, the first available I/O address in the displayed list appears as the default. The hardware I/O address will be set to match the software assignment(s) later in Chapter 4. The following is an example of how the display and prompt may appear on your screen:

Please enter the following system configuration information for IPC-1600 Board 1. The available starting I/O addresses for the IPC-1600 Board 1 are:

Starting I/O address: 100 (default)  
Starting I/O address: 110  
Starting I/O address: 120  
Starting I/O address: 200  
Starting I/O address: 220  
Starting I/O address: 300  
Starting I/O address: 320

Type the starting I/O address and strike the ENTER key or type Q to cancel installation. Striking the ENTER alone will select the default:

Remember that if you are adding more than one board, the I/O address range should not conflict with any other boards in the system. Each board in the system must be assigned a unique I/O address.

Either press the **ENTER** key (to enter the default) or type in the name of the starting I/O address that you wish to assign and then press **ENTER**.

Be sure to write down the address(es) that you specify.

## Assigning Board-Unique Starting Controller Memory Address

If you specified board-unique controller memory assignment, the system now displays a list of available starting controller memory addresses and prompts you to enter the address to be assigned to the board. The IPC-1600 comes from the factory with the controller memory address range set to 080000h—08FFFFh; if 080000h—08FFFFh is already assigned, the first available starting controller memory address in the displayed list appears as the default. The hardware controller memory address range(s) will be set to match the software assignment(s) later in Chapter 4. The following screen shows the typical display.

Please enter the following system configuration information for IPC-1600 Board 1. The available starting controller memory addresses for the IPC-1600 Board 1 are:

Starting Memory address(s):

080000 (default)	090000	100000
180000	200000	280000
300000	380000	400000
480000	500000	580000
600000	680000	700000
780000	800000	880000
900000	980000	A00000
A80000	B00000	B80000
C00000	C80000	D00000
D80000	E00000	E80000
F00000	F80000	

Type the starting controller memory address and strike the ENTER key or type Q to cancel installation. Striking the ENTER alone will select the default:

Either press the **ENTER** key (to enter the default) or type in the name of the controller memory address that you wish to assign and then press **ENTER**.

Remember that if you are adding more than one board, the controller memory addresses should not conflict. The IPC-1600 is 16-bit transfer board requiring 64KB of host memory. Also, 8-bit and 16-bit transfer boards cannot share a 128KB memory window. Controller memory address space cannot conflict with Basic Input/Output System (BIOS) shared memory.

Be sure to write down the address(es) that you specify.

## Confirming the Data

After you enter the three items of data, a confirmation screen displays your choices and prompts you either to verify what you have selected or to indicate that it is unacceptable. The following is an example of how the display and prompt may appear on your screen:

```
*****
Board 1 configuration :
  Ports Card Type = IPC-1600
  Interrupt Number = 10
  I/O ports Starting address = 100
  Controller Memory Starting address = 080000
*****

Is this configuration acceptable? (y or n)
```

To accept the data, press the **Y** key and then press the **ENTER** key. You may now install another board or quit the installation sequence. However, if you wish to change the data, press the **N** key and then press the **ENTER** key. If you reject the configuration, you must go through the sequence of prompts for this board from the beginning.

If you initially specified that you wanted to install more than one board, you will be prompted to go through the same procedure for the remaining boards. As noted earlier, if the factory-assigned default is already assigned, the first available item in the displayed list automatically becomes the default.

The system limits the number of Ports boards that you can install according to the availability of interrupts and addresses. A maximum of seven boards can be supported (dependent on the machine configuration) if one IRQ level is being shared among all the IPC-1600 boards.

To quit the installation sequence when quit is an option, press the **Q** key and then press the **ENTER** key.

Following the acceptance of the last board, an overall IPC-1600 configuration summary is displayed. The following is an example of how the display and prompt may appear on your screen:

Board # -----	TYPE -----	IRQ ---	I/O Addr. -----	Mem. Addr -----
1.	IPC-1600	10	100	080000
2.	IPC-1600	10	110	080000
Is this configuration acceptable? (y or n)				

To accept the data, press the **Y** key and then press the **ENTER** key. However, if you wish to change the data, press the **N** key and then press the **ENTER** key. Rejecting the configuration terminates the installation script with nothing being installed. To restart the installation process, enter **installpkg** at the beginning of this chapter.

## Completing Driver Installation

After you enter **Y** in response to the last prompt, the system completes the driver installation by rebuilding the UNIX system kernel. This process takes several minutes.

The following message appears:

```
The UNIX Operating System will now be rebuilt.  
This will take approximately 2 minutes. Please wait.
```

```
The UNIX Kernel has been rebuilt.
```



Once the kernel has been rebuilt, another message displays:

**Confirm**

To complete the install/remove process a shutdown is now being initiated automatically.

Make sure your floppy drive is empty. If you are installing or removing controller boards, you may power down the system after the shutdown has completed.

Strike **ENTER** when ready  
or **ESC** to stop.

Remove the “Intelligent Ports Card (IPC-1600) UNIX System V/386 Device Drivers, Version 1.0.” diskette from the diskette drive and properly store the diskette.

Press **ENTER**. This automatically shuts down the system. You may now proceed to the hardware phase of installation.

After you have completed the hardware phase of installation (Chapter 4), you will need to power up the system, which will boot the UNIX system.

When the system reboots, a new kernel environment is set up and the board(s) will be fully installed.

---

# Modifying Kernel Configuration

## Removing All IPC-1600 Boards

To remove all IPC-1600 board information from the kernel, log in as “root” and execute **removepkg**. When prompted, select the “IPC-1600, Intelligent Ports Card — Version 1.0” item.

## Changing IPC-1600 Configuration

You can reinstall the driver on top of the current driver when you need to add or change the IPC-1600 configuration information. To change the existing configuration of IPC-1600 board(s), reinstall the “Intelligent Ports Card (IPC-1600) UNIX System V/386 Device Drivers, Version 1.0” software package (**installpkg**). Specify the proper number of boards and then assign the appropriate interrupt request level, I/O address, and starting memory controller address for each board.

Following shutdown, power down the system and set the DIP switches on the IPC-1600 to match the information specified to the device driver. The new configuration will be installed when the system is powered up.

---

## Chapter 4: Hardware Installation

---

# Introduction

The IPC-1600 board can be installed in any 16-bit or 32-bit bus expansion slot in following machines:

- AT&T 6386E Work Group System
- AT&T 6386/25 Work Group System
- AT&T 6386E/33 Work Group System
- AT&T 6386E/33 Work Group System Model S.

Refer to the appropriate “*User's Guide*” supplied with your machine for board installation instructions. This chapter guides you through the process of installing the appropriate hardware. However, refer to the documentation that came with your system for instructions on how to install/remove a bus expansion slot board.

Also, be sure to refer to the notes you were instructed to make when you were installing the software (Chapters 2 and 3). You will need these notes to set the various switch settings on the IPC-1600 board.

Although this chapter does not explicitly cover removing a board or installing an additional board or boards at a later time, the instructions provided here can help you do future hardware changes.

**Note:** Each IPC-1600 board in the system must be assigned a unique I/O address, a controller memory address range, and a hardware Interrupt ReQuest (IRQ) level which do not conflict with any other board types in the system. All IPC-1600 boards in a system must be set up to support ONE of the following conditions:

1. Share controller memory and share one IRQ level (preferred condition)
2. Share controller memory and have unique IRQ levels
3. Unique controller memory address assignments and share one IRQ level
4. Unique controller memory address assignments and unique IRQ levels.

---

# Preparation

## Prepare Machine for Installation

If the machine is powered-up and is running the UNIX operating system, use the **shutdown** command to bring down the operating system as shown in the following screen display.

```
# cd /  
# shutdown
```

Set the power switch of the system and of all external devices to “OFF.”

Unplug the system module power cord.

Using the documentation that came with your machine, prepare an expansion bus slot for the installation of a board. This will typically require the removal of a cover and a board slot filler plate.

## Prepare the IPC-1600 for Installation

### Set the Controller Memory Starting Address

Locate the DS1 Dual In-line Package (DIP) switch (a group of eleven switches) on the IPC-1600. Refer to Appendix A, “Hardware Parameter Settings,” for switch location information and instructions on how to set the controller memory starting address (DS1, SW8 through SW1) to correspond to the values established when installing the software (Chapters 2 and 3).

### Set the Input/Output Port Address

Next, locate the DS1 DIP switch. Set the selected I/O port address (DS1, SW11 through SW9). For switch location information and instructions on how to set the selected I/O starting address, refer to Appendix A. Set the I/O port address switches to correspond with the values specified when installing the software (Chapter 2 and 3).

If you are adding more than one board, make sure that the selected I/O starting addresses you are now specifying do not conflict.

### Set the Interrupt Request Level

Locate the DS2 DIP switch. Follow the instructions in Appendix A for setting the IRQ level. Again, each IPC-1600 board that you install can have its own IRQ level or one IRQ can be used for all IPC-1600 boards. Set the IRQ switches to correspond to the IRQ level specified when installing the software (Chapters 2 and 3).

---

## Connect the 16-Ports Fanout Module Cables

After setting the I/O port address, the controller memory starting address, and the hardware interrupt request level for the board, you are ready to connect the ribbon cables and port modular cables to the 16-Ports Fanout module as follows.

If you have the optional AT&T IPC-1600 Ports Cabinet, locate and install the cabinet now. Refer to Appendix C, “AT&T IPC-1600 Ports Cabinet,” and the documentation that came with the cabinet for installation information. After installing the cabinet, return to this procedure to “Connect the Ribbon Cables to the IPC-1600” and “Install the Board” in the host computer.

If you DO NOT have the optional AT&T IPC-1600 Ports Cabinet, locate the two 80-conductor ribbon cables and the 16-Ports Fanout module. Connect the ribbon cables to the 80-pin connectors at the rear of the 16-Ports Fanout module. The connectors on the ribbon cables are keyed for proper alignment with the connectors at the rear of the fanout module. Make sure that the retaining clips are properly secured.

If you DO NOT have the optional AT&T IPC-1600 Ports Cabinet, connect the port modular cables to the 16-Ports Fanout module. When connecting the modular cables to the 16-Ports Fanout module, it is important to label (identify) the circuit(s). The label information should include the port identification (ttyxyy) and the connecting device identification. Be sure to connect the ground lead of the modular cable to the ground lug on the 16-Ports Fanout module.

---

## Connect the Ribbon Cables to the IPC-1600

Route the ribbon cables from the 16-Ports Fanout module to the host computer. Thread the ends of the ribbon cables through the board slot opening in the host computer and connect them to the IPC-1600 board. The connectors are keyed for proper alignment with the 80-pin headers on the board. Observe the port markings on the front of the 16-Ports Fanout module to insure correct port numbering on the fanout module. Connect the ribbon cable for ports 9 through 16 to header P3. Connect the ribbon cable for ports 1 through 8 to header P4. Refer to Appendix B, “Serial Input/Output Device Interface,” for more information on these connections. Make sure that the retaining clips are properly secured.



---

# Install the Board

Follow the instructions in the documentation that came with your machine for installing a board.

Carefully pass the excess ribbon cable through the board slot opening until the board can be plugged into the 16- or 32-bit Industry Standard Architecture (ISA) bus connector. Align the IPC-1600 board with the selected board slot and plug the board into the corresponding connector.

Secure the IPC-1600 board with the mounting bracket using the 2.25-inch long-shank screws. Then secure the bracket to the chassis with the screw previously used for the filler plate.

After the entire IPC-1600 system has been installed, check that all mechanical connections have been tightened before putting the system back together and applying power to the system. Make sure that all cables have been neatly routed and do not pose a hazard to personnel.

---

## Chapter 5: Managing the Serial Ports

---

# Introduction

This chapter defines the IPC-1600 device node names used in the UNIX system. This chapter also describes how to manage the serial I/O ports using either the **hipcutils(1)** command or the AT&T Framed Access Command Environment (FACE), which is optionally available with the UNIX System V/386 Release 3.2 and later. (If you are using the UNIX System V/386 Release 3.2 or later but do not have FACE, refer to the *UNIX System V/386 Operations/System Administration Guide*.)

---

# Definition of IPC-1600 Device Node Names

## Node Names

There are two classes of device node names:

- **ttyis***xyy* (for software)
- **ttyih***xyy* (for hardware).

The *x* is the board occurrence number. Board numbers are 1 through 7. The *yy* is the port number on the IPC-1600 board. Port numbers are 01 through 16.

The following table shows all available device names for the serial ports with multiple IPC-1600 installation.

IPC-1600 Board Number	Device Names for Ports 1 through 16
1	/dev/ttyis101 — /dev/ttyis116 (no RS-232C handshake) /dev/ttyih101 — /dev/ttyih116 (with RS-232C handshake)
2	/dev/ttyis201 — /dev/ttyis216 (no RS-232C handshake) /dev/ttyih201 — /dev/ttyih216 (with RS-232C handshake)
3	/dev/ttyis301 — /dev/ttyis316 (no RS-232C handshake) /dev/ttyih301 — /dev/ttyih316 (with RS-232C handshake)
4	/dev/ttyis401 — /dev/ttyis416 (no RS-232C handshake) /dev/ttyih401 — /dev/ttyih416 (with RS-232C handshake)
5	/dev/ttyis501 — /dev/ttyis516 (no RS-232C handshake) /dev/ttyih501 — /dev/ttyih516 (with RS-232C handshake)
6	/dev/ttyis601 — /dev/ttyis616 (no RS-232C handshake) /dev/ttyih601 — /dev/ttyih616 (with RS-232C handshake)
7	/dev/ttyis701 — /dev/ttyis716 (no RS-232C handshake) /dev/ttyih701 — /dev/ttyih716 (with RS-232C handshake)

## Software Device Class

The **/dev/ttyisxyy** device type must be used for I/O devices (terminals, printers, MODEMs, etc.) when software flow control is desired.

The **ttyisxyy** class of device node names does not support hardware flow control via the standard Electronic Industries Association (EIA) RS-232C hardware handshaking signals (CTS and RTS). Flow control is provided under software control. Any change in the status of Data Carrier Detect (DCD) causes the **getty** to respawn.

The **/dev/ttyisxyy** name directs the IPC-1600 to ignore all RS-232C control signals, except Data Carrier Detect (DCD), and to use software flow control over the Transmit Data (TD) and Receive Data (RD) lines. Characters can be transmitted and received when DCD is not asserted. The connection is dropped when DCD is asserted and then dropped.

## Hardware Device Class

The **ttyih**<sub>xyy</sub> provides the standard EIA RS-232C hardware handshaking and monitors the following:

- Data Carrier Detect (DCD)
- Clear To Send (CTS)
- Ring Indicator (RI).

The detection of the DCD loss causes the port to log off if the Hang UP on final C<sub>l</sub>ose (HUPCL) flag is set. In addition, the presence of the CTS signal enables the IPC-1600 transmitter and the presence of the DCD signal enables the IPC-1600 receiver.

The **/dev/ttyih**<sub>xyy</sub> device type directs the IPC-1600 to:

- Turn ON the RS-232C control signals, such as Data Terminal Ready (DTR) and Request To Send (RTS)
- Monitor these input status signals:
  - Clear To Send (CTS)
  - Data Carrier Detect (DCD)
  - Ring Indication (RI).

The **/dev/ttyih**<sub>xyy</sub> device type must be used with I/O devices (terminals, printers, MODEMs, etc.) when RS-232C hardware handshake signals are desired (RTS and CTS).

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# IPC-1600 Administration Via hipcutils

The **hipcutils** command is used to administer IPC-1600 ports. The command is used to reset ports that are hung or otherwise not operable and to configure the Data Carrier Detect (DCD) wink and break durations for a port.

Refer to the **hipcutils**(1) manual page which is provided as part of this package for additional information.



---

# UNIX System V Release 3.2

## Administration Via FACE

The AT&T Framed Access Command Environment (FACE) subsystem is an optionally orderable product which provides an enhanced UNIX system user interface. Contact your AT&T Service Representative or authorized dealer for more information.

The serial I/O ports are all under the control of the FACE subsystem which is under the UNIX system.

AT&T FACE is a character-based user interface which presents the user with a logical view of the UNIX System V environment. AT&T FACE displays easy-to-use menus to commonly used commands, task scheduling, program services, and administration. The AT&T FACE utility provides an optionally-installable, context-sensitive help facility.

If your system includes FACE and the IPC-1600 FACE menus have been installed, you can make the appropriate selections by invoking it. At the UNIX system prompt (a # sign), enter **face** to invoke the AT&T FACE.

Once inside the AT&T FACE Menu, select the System Administration option.

From the System Administration Menu, select the Peripherals Setup option. From the Peripheral Setup Menu, select the following:

- Serial Ports Setup option to administer the serial ports,
- Configure IPC-1600 Port Break/Wink option to administer the duration of the break and Data Carrier Detect (DCD) signals,
- Reset IPC-1600 Port option to reset a port.

Follow the instructions provided in the *UNIX System V/386 Release 3.2 FACE User's/Administrator's Guide*.

When you have completed administration through FACE, press the **F6** (CANCEL) key to return to the AT&T FACE Menu.

Note that when you are administering serial ports, the Flow Control field is used to select the **ttys**xyy or **ttih**xyy device. Selecting the Software option for the Flow Control field selects the **ttys**xyy device; the Hardware option selects the **ttih**xyy device.

In order for the Flow Control selection to select the device properly, you must explicitly set the Flow Control field or, at the least, you must move the cursor through the field.

For Serial Printer Setup using the IPC-1600, select the “Serial Printer Port Setup” and refer to the *UNIX System V/386 Release 3.2 FACE User’s/Administrator’s Guide* for additional information.

Refer to Chapter 7, “Troubleshooting the Intelligent Ports Card,” for some “Helpful Hints” in setting port characteristics.

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## Chapter 6: System Features

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# Features

The IPC-1600 works in either 16-bit or 32-bit expansion I/O slots.

The IPC-1600 provides sixteen identically configured serial I/O ports with a full complement of Electronic Industries Association (EIA) RS-232C/Consultative Committee International Telegraph and Telephone (CCITT) V.28 standard interface on both input and output supporting the following signals:

- Transmit Data (TD)
- Receive Data (RD)
- Data Terminal Ready (DTR)
- Data Set Ready (DSR)
- Receive Line Signal Detector (RLSD) or Data Carrier Detect (DCD)
- Request To Send (RTS)
- Clear To Send (CTS)
- Ring Indicator (RI)
- Signal Ground (SG).

Each serial port has the following capabilities:

- Full or half-duplex mode.
- Programmable data bits (5, 6, 7 or 8).
- 1 or 2 stop bits.
- Error detection:
  - Framing errors
  - Parity errors
  - Loss of carrier
  - Break handling.
- Parity options: EVEN/ODD/NONE parity.

- Break sequence (transmit data line held “low” for two consecutive stop-bit sequences).

In addition, modem-handshaking line discipline and receive-error detection (such as framing error, data overrun error, and parity error) are built in.

Transmit and receive data are buffered through the on-board Static Random Access Memory (SRAM) and passed between the IPC-1600 and the host processor via the high-speed dual-ported SRAM to enhance system performance.

The IPC-1600 comes with the following standard features:

- On-board, high-speed SRAM
- Error checking on receive
- Input and output data hardware and software flow control.

The serial I/O ports can be mapped into the MS-DOS and UNIX system environments to provide a total of 64 ports (four IPC-1600 boards). When one IRQ level is shared among seven IPC-1600 boards, 112 ports can be supported.

The IPC-1600 base memory address and I/O base address are both configurable via on-board DIP switches.

One IRQ line can be assigned for each IPC-1600 or shared among all equipped IPC-1600s out of a total possible eight interrupts (IRQ3—IRQ5, IRQ7, IRQ10—IRQ12, and IRQ15). A maximum of seven boards can be equipped when one IRQ is shared among all IPC-1600s. A maximum of four board can be equipped when one IRQ is assigned per board.

Eight 8530 serial communications controllers function as dual-channel, Universal Asynchronous Receiver-Transmitters (DUARTs) to provide a total of sixteen RS-232C channels (ports) complete with the following features:

- Programmable baud rates, data bits, parity bits, stop bits
- Control of DTR, RTS, and TD
- Detection of RD, CTS, DCD, RI, and BREAK.

---

## Performance Characteristics

The IPC-1600 supports the following bit per second rates: 38400, 19200, 9600, 4800, 2400, 1800, 1200, 600, 300, 200, 150, 134.5, 110, 75, and 50.

The performance of the IPC-1600 expressed in terms of line occupancy at a prescribed baud rate in the raw and cooked modes with no flow control is as follows. In the cooked mode, canonical processing is enabled. In the raw mode, canonical processing is disabled. The line occupancy formula is:

$$\text{Line Occupancy (\%)} = \frac{\text{\# of transmitted characters per second}}{\text{bit rate / bits per character}} \times 100$$

**Note:** The line occupancy formula may have results greater than 100%. This is reserve capacity that is NOT achievable. The following line occupancy results are typical of an AT&T 6386E/33 WGS Model S with one IPC-1600 board.

The input capacity of the IPC-1600 is determined by the number of lines (ports) simultaneously operating at 100% occupancy with no flow control as follows.

<b>Raw Mode:</b>	16 ports at 4,800 bps
	16 ports at 9,600 bps
	8 ports at 19,200 bps
	2 ports at 38,400 bps
<b>Cooked Mode:</b>	16 ports at 4,800 bps
	16 ports at 9,600 bps
	7 ports at 19,200 bps
	2 ports at 38,400 bps (with 75% occupancy)

The output capacity of the IPC-1600 is determined by the number of lines (ports) simultaneously operating at 98% occupancy with no flow control as follows.

<b>Raw Mode:</b>	16 ports at 4,800 bps
	16 ports at 9,600 bps
	14 ports at 19,200 bps
	7 ports at 38,400 bps
<b>Cooked Mode:</b>	16 ports at 4,800 bps
	16 ports at 9,600 bps
	14 ports at 19,200 bps
	7 ports at 38,400 bps

Operating beyond these input limits with no flow control will result in loss of characters. Operating beyond these input limits WITH flow control will result in decreased line occupancy and no data loss. No data loss is associated with output regardless of flow control; however, reduced occupancy will result if these limits are exceeded.

---

## Power Consumption

The IPC-1600 is supplied with +5V, +12V, and -12V via the Industry Standard Architecture (ISA) adapter card. The total typical case power consumption is as follows:

+5V @ 2.00 Amperes =	10.0 Watts
+12V @ 0.07 Amperes =	0.8 Watts
-12V @ 0.10 Amperes =	1.2 Watts
<hr/>	
Total Power =	12.0 Watts (Typical)



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## Chapter 7: Troubleshooting the Intelligent Ports Card

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# Introduction

This chapter includes detailed information on troubleshooting the Intelligent Ports Card and the use of the diagnostic program supplied on the “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0” diskette. Information on how to use the IPC-1600 with other products and other “Helpful Hints” are also provided in this chapter.

**Note:** Systems running the UNIX operating system must either create a native MS-DOS partition on the system disk and make it the active partition or boot native MS-DOS from a diskette drive to run the IPC-1600 diagnostics. The **IPC16DIA.COM** file on the diskette is copied to the system disk drive to run the diagnostics from the system disk drive. When MS-DOS is booted from diskette, the IPC-1600 diagnostics are run from IPC-1600 MS-DOS diskette. Refer to the MS-DOS documentation for information on creating a MS-DOS partition and copying files.

---

# MS-DOS Boot Error Message

The following error messages may be displayed at system boot time and can be caused by an incorrect board configuration.

SRAM MEMORY ERROR *(Indicates faulty memory or memory not found.)*

BIOS RESET ERROR *(Indicates BIOS failed to initialize correctly.)*

The following error messages may be displayed at system boot time and can be caused by a hardware problem.

FEPOS CODE MOVE ERROR *(Indicates error when loading the on-board operating system.)*

FEPOS INITIALIZATION ERROR *(Indicates the on-board system failed to initialize.)*

In response to these error messages, do the following.

- Check that the board parameters match the parameters specified by the **IPC16CNF** program.
- Try to reload the *IPC16DOS.SYS* driver.
- If the system still fails, recopy the driver from the “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0” diskette to the hard disk drive and try to reload the driver.
- Run the diagnostics.
- Call the AT&T HOTLINE at 1-800-922-0354 for help, as necessary.

---

# IPC-1600 Diagnostics

## Copy Diagnostics to the System Disk

**Comment:** This procedure is only for systems running native MS-DOS from the system disk drive.

Power up the system [AT&T Work Group System (WGS) computer] to boot native MS-DOS (Version 3.0 or later) from the system disk drive.

Insert the “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0” diskette into the appropriate diskette drive and close the diskette drive door.

Use the MS-DOS **COPY** command to copy the *IPC16DIA.COM* file from the diskette to the system disk. It is recommended that you create a separate directory for the IPC-1600 files as shown in the following examples. Note that system prompts are machine dependent.

As shown in the following screen display, first shift from the “A” drive to the “C” (system disk) drive and create a directory named *IPC* as follows.

---

```
A: $ C:
```

```
C: $ mkdir ipc
```

```
C: $
```

Now, change directory (**cd**) to *IPC* and copy the *IPC16DIA.COM* file on the diskette in the “A” drive or in the “B” drive to the system disk drive as follows. The example uses the “A” drive.

*Change directory to an optional separate directory to contain the IPC-1600 software.*

```
C: $ cd ipc
```

*Copy the file from the “A” drive to the “C” drive*

```
C:\IPC $ copy a:ipc16dia.com /v
A:IPC16DIA.COM
      1 File(s) copied
```

```
C:\IPC $
```

Remove the “Intelligent Ports Card (IPC-1600) MS-DOS Device Drivers and Diagnostics, Version 1.0” diskette from the diskette drive and properly store the diskette.

The IPC-1600 diagnostic program is now executable from the system disk by entering **\ipc\ipc16dia** or just **ipc16dia** if the current working directory is *\IPC* or if the command search path includes *\IPC*.

## How to Run Diagnostics

IPC-1600 diagnostics are run by executing the **IPC16DIA** program under native MS-DOS. There are six diagnostics which can be selectively executed from the **IPC16DIA** program. The program is terminated by the ESC key.

Note that it is necessary to change the controller memory address assignment IPC-1600 boards set above 1MB to an address supported by diagnostics. Remember to reset the controller memory address switches for UNIX system operation, as applicable. Refer to Appendix A, "Hardware Parameter Settings," for switch location and value information. Diagnostics support only controller memory starting addresses 080000h, 090000h, 0A0000h, 0B0000h, 0C0000h, 0D0000h, and 0E0000h.

The opening screen of the **IPC16DIA** program is as follows. As you respond to the prompts to enter the I/O address, starting memory controller address, and IRQ for the board to be tested, the screen is automatically updated to show the selections.

```
-----
*****      IPC-1600 DIAGNOSTICS      *****      Version 1.5.0      *****
-----

ESC will exit the IPC-1600 diagnostics and return to the system.

IPC-1600 Selected parameters:   I/O =           Memory =           IRQ =

Select an appropriate number (1-7) for the IPC-1600 I/O address:
1)100   2)110   3)120   4)200   5)220   6)300   7)320
```

You are next asked to select the starting memory address for the board to be tested as follows.

```
Select the appropriate number (1-7) for the IPC-1600 memory address:
1)80000H  2)90000H  3)A0000H  4)B0000H  5)C0000H  6)D0000H  7)E0000H
```

You are then asked to specify the IRQ level for the board to be tested as follows.

```
Select the appropriate number (1-8) for the IPC-1600 IRQ:
1)3  2)4  3)5  4)7  5)10  6)11  7)12  8)15
```

After the I/O address, starting controller memory address, and IRQ level are entered, any of the six tests can be repeated/executed by entering the test number. A record is maintained on the screen of the number of times each test is executed, the number of times each test passed, and the number of times each test failed. The following screen shows the initial conditions after the board to be tested has been defined.

```
-----
*****          IPC-1600 DIAGNOSTICS          *****          Version 1.5.0          *****
-----

ESC will exit the IPC-1600 diagnostics and return to the system.

IPC-1600 Selected parameters:  I/O = 100          Memory = 80000H          IRQ = 10

Select the appropriate test number (1-6):
```

	TOTAL	PASS	FAIL
1) Host 64K dual-ported memory tests	00	00	00
2) Host/IPC-1600 interface tests	00	00	00
3) IPC-1600 64K dual-ported memory tests	00	00	00
4) IPC-1600 16K local memory tests	00	00	00
5) IPC-1600 FEPOS integrity tests	00	00	00
6) IPC-1600 Communication ports tests	00	00	00

```
*****
```

The **IPC16DIA** program is terminated by entering an escape (ESC). The following screen shows that all diagnostics were successfully executed once for the specified board and then an ESC entered to quit the program.

```
-----
*****      IPC-1600  DIAGNOSTICS      *****      Version 1.5.0      *****
-----

ESC will exit the IPC-1600 diagnostics and return to the system.

IPC-1600 Selected parameters:  I/O = 100      Memory = 80000H      IRQ = 10

Select the appropriate test number (1-6) : <ESC>
TOTAL      PASS      FAIL
1) Host 64K dual-ported memory tests      01      01      00
2) Host/IPC-1600 interface tests      01      01      00
3) IPC-1600 64K dual-ported memory tests      01      01      00
4) IPC-1600 16K local memory tests      01      01      00
5) IPC-1600 FEPOS integrity tests      01      01      00
6) IPC-1600 Communication ports tests      01      01      00
*****
Test 1 in progress
Test passed
Select another test or ESC

IPC-1600 DIAGNOSTICS COMPLETE
```



## IPC-1600 Test Descriptions

### Host 64KB Dual-Ported Memory Tests

The host processor dual-ported memory test diagnostics execute in the host processor. These tests write to memory, read the memory, and compare what is read to what was written. The IPC-1600 is held reset and the dual-ported memory is enabled during test execution.

### Host/IPC-1600 Interface Tests

The host processor/IPC-1600 interface tests execute in both the host processor and the IPC-1600. The IPC-1600 is reset and the BIOS is downloaded and executed. The host processor sends a Non-Maskable Interrupt (NMI) to the IPC-1600 and the IPC-1600 responds with an IRQ to acknowledge the NMI. The test passes if the interrupt communication is successful in both directions.

### IPC-1600 64K Dual-Ported Memory Tests

The dual-ported memory tests execute in both the host processor and the IPC-1600. The IPC-1600 is reset and the BIOS is downloaded and executed. The host processor downloads the diagnostic and transfers control from the BIOS to the test routine. The diagnostic executive in the host processor monitors the test results.

### IPC-1600 16K Local Memory Tests

The 16KB local memory tests execute in both the host processor and the IPC-1600. The IPC-1600 is reset and the BIOS is downloaded and executed. The host processor then downloads the diagnostic tests and transfers control from the BIOS to the test routine. The IPC-1600 executes the tests and the diagnostic executive in the host processor monitors the test results.

### IPC-1600 FEPOS Integrity Tests

The Front End Processor Operating System (FEPOS) integrity tests execute in both the host processor and the IPC-1600. The IPC-1600 is reset, the BIOS is downloaded and executed, and the FEPOS is downloaded and executed. The diagnostic executive in the host processor monitors the FEP operating system for test results.

## IPC-1600 Communication Ports Tests

The communication ports tests execute in both the host processor and the IPC-1600. These tests use the IPC-1600 FEPOS to exercise each port on the IPC-1600.

A combination of four baud rate (1200, 9600, 19200, and 38400 bps), four data word sizes (5, 6, 7, and 8 bits), two stop bits (1 and 2), and three parity selections (none, odd, and even) are used to test each port. Each port is programmed to an internal loopback mode; therefore, external loop around cables are not needed. However, note that the transmit data is available at the port for external use while in the loopback mode. Any test data appearing on a terminal connected to a port under test should be ignored since the communication ports diagnostics are internal, standalone tests.

---

## Helpful Hints

Typically, the lower interrupts on the Industry Standard Architecture (ISA) bus are used by other circuit boards in the system. Therefore, to prevent configuration conflicts, try using some of the higher interrupts (IRQ 10, IRQ 11, and IRQ 15) for the Intelligent Ports Card.

Make sure that the Intelligent Ports Card is installed in a 16-bit or a 32-bit ISA-compatible bus slot.

Make sure that the hardware for the Intelligent Ports Card correctly corresponds to the software selections for the I/O address, starting controller memory address, interrupt request level, and board type.

When possible, use the default settings during the installation of the Intelligent Ports Card.

Use shared IRQ level and controller memory starting address assignment whenever possible.

Use controller memory address space below 1MB when possible. The use of controller memory address space below 1MB is required for native MS-DOS and diagnostics operation.

IPC-1600 boards may not work correctly if configured to share a 128KB controller memory address space with other boards types. This is because the IPC-1600 uses highly efficient 16-bit data transfers, and many other boards use less efficient 8-bit technology. The ISA bus architecture precludes mixing the two board types in the same 128KB address space.

Boards can be assigned controller memory address space above 1MB for UNIX system operation and reassigned to use supported address space for the purpose of diagnostics (by changing switch settings). Remember to reset the switches for UNIX system operation.

Some applications may be coded assuming input buffer overflow at 256 characters. The IPC-1600 uses 257 character input buffers.

If you are using an 8-conductor cable, make sure that the cable is straight through. A 3B2 computer 8-conductor cable that provides cross-overs between the two modular ends will NOT work.

When using intelligent terminals (for example, AT&T 630 MTG) with MS-DOS application programs through Simul-Task 386, make sure that all function keys are correctly set.

When using a Hayes\* compatible MODEM, dial out once to configure the MODEM before calling into the MODEM.

The AT&T 446 Laser Printer and the HP† LaserJet Series II printer must be installed on a serial port configured as a **ttyih**xyy device under the UNIX system.

Use **stty clocal** to prevent loss of printer data for printers which raise Data Carrier Detect (DCD) to signal erroneous data. These printers include the AT&T 446 Laser Printer and the HP LaserJet Series II printer.

Use **stty -clocal** to allow UNIX system detection of printer disconnect.

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\* Registered trademark of Hayes Microcomputer Products, Incorporated

† Registered trademark of Hewlett-Packard Company

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## Appendix A: Hardware Parameter Settings

---

## Switch, Jumper, Connector Location Information

The IPC-1600 has switches for selecting the following:

- Controller memory starting address range (DS1, SW8 through SW1)
- I/O port address (DS1, SW11 through SW9)
- Hardware Interrupt ReQuest (IRQ) level (DS2, SW8 through SW1).

A jumper (shunt) is used for selecting the size of local program Random Access Memory (RAM) (J1). Jumper J1 has been set at the factory to the correct position. This jumper is documented in this appendix so you can verify the selection.

Figure A-1 shows the location of DS1, DS2, J1, and the ports fanout connections (P3 and P4) on the IPC-1600.

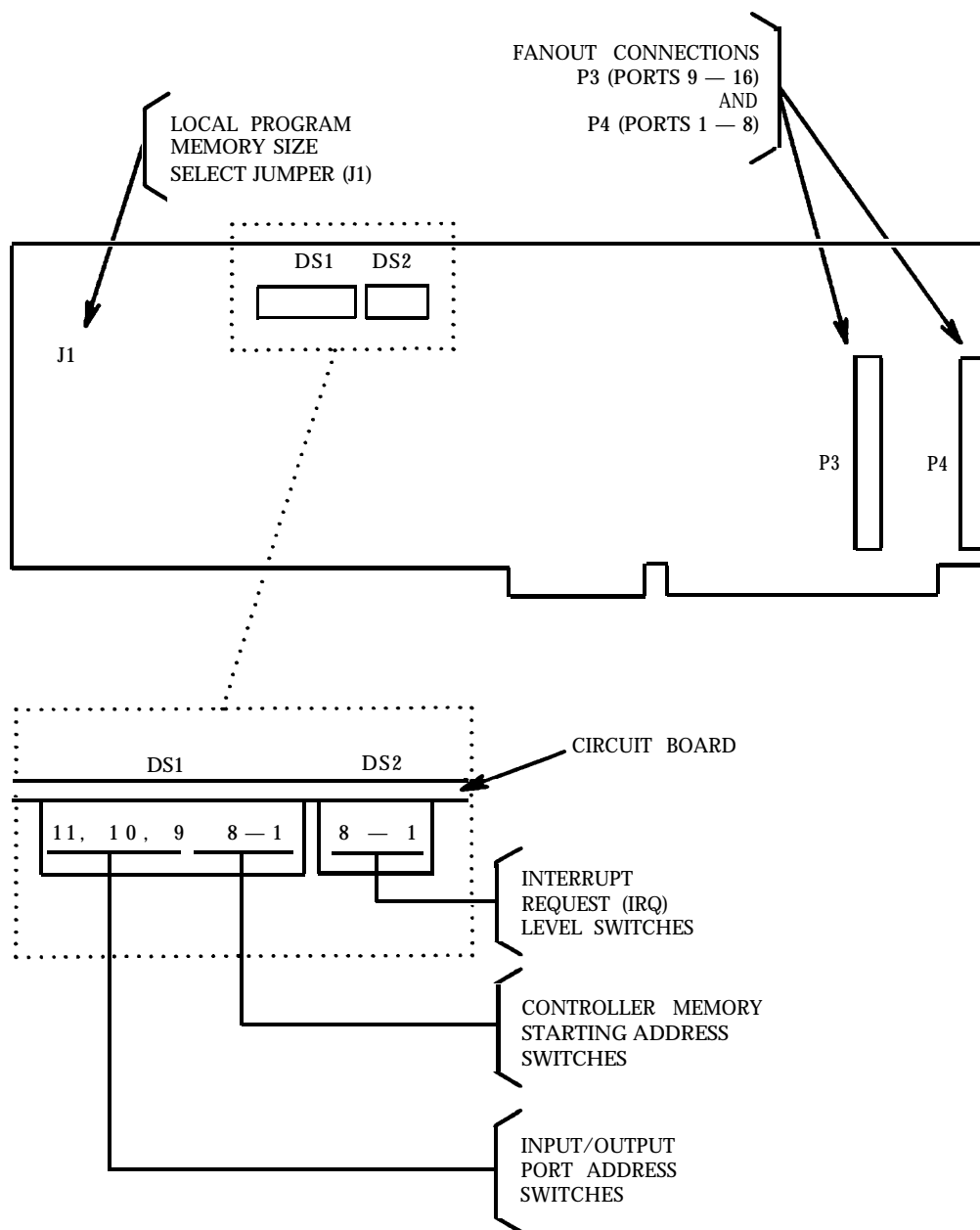


Figure A-1: Switch, Jumper, and Connector Location Information

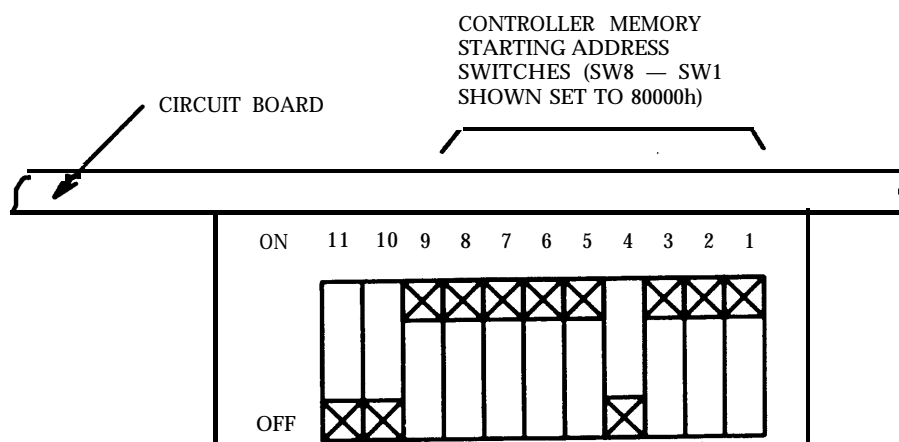
---

---

## DS1 Switch Settings—Controller Memory Starting Address

The factory set controller memory starting address (hexadecimal) is 80000h. (The **h** is used to denote a hexadecimal number.)

The Dual In-line Package (DIP) switch designated DS1, SW8 through SW1 selects the base or starting address of RAM. The address range must be set such that it does not conflict with other RAM, ROM, or memory mapped I/O address in the PC system. This address range must be consistent with the software being used. Figure A-2 shows switch DS1 with the controller memory starting address set to the factory setting (80000h).



☒ - Switch pushed "IN" or to the indicated position.

ON = 0 = Closed

OFF = 1 = Open

Figure A-2: DS1 Controller Memory Starting Address Switches (Default Setting)

---



The following table shows the switch settings for some of the possible controller memory starting addresses.

**Note:** The IPC-1600 UNIX system driver installation scripts support only selected starting controller memory addresses as standard. The installation script displays the appropriate standard addresses dependent on the available system configuration resources. For the a typical AT&T 6386E Work Group System, the installation script identifies the following available controller memory addresses.

080000h	090000h	100000h
180000h	200000h	280000h
300000h	380000h	400000h
480000h	500000h	580000h
600000h	680000h	700000h
780000h	800000h	880000h
900000h	980000h	A00000h
A80000h	B00000h	B80000h
C00000h	C80000h	D00000h
D80000h	E00000h	E80000h
F00000h	F80000h	

The recommended controller memory address range is 080000h through 0BFFFFh for the following machines:

- AT&T 6386E Work Group System
- AT&T 6386/25 Work Group System
- AT&T 6386E/33 Work Group System
- AT&T 6386E/33 Work Group System Model S.

The available controller memory address range is 080000h through F80000h. However, the installation software supports only selected starting addresses within this range as shown in the previous listing.

DS1 CONTROLLER MEMORY STARTING ADDRESS SETTINGS								
(See Figure A-2)								
ADDRESS (Hexadecimal)	SWITCH POSITIONS							
	8 (A23)	7 (A22)	6 (A21)	5 (A20)	4 (A19)	3 (A18)	2 (A17)	1 (A16)
<b>080000—08FFFF*</b>	ON	ON	ON	ON	OFF	ON	ON	ON
090000—09FFFF	ON	ON	ON	ON	OFF	ON	ON	OFF
0A0000—0AFFFF	ON	ON	ON	ON	OFF	ON	OFF	ON
0B0000—0BFFFF	ON	ON	ON	ON	OFF	ON	OFF	OFF
0C0000—0CFFFF	ON	ON	ON	ON	OFF	OFF	ON	ON
0D0000—0DFFFF	ON	ON	ON	ON	OFF	OFF	ON	OFF
0E0000—0EFFFF	ON	ON	ON	ON	OFF	OFF	OFF	ON
0F0000—0FFFFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF
100000—10FFFF	ON	ON	ON	OFF	ON	ON	ON	ON
110000—11FFFF	ON	ON	ON	OFF	ON	ON	ON	OFF
120000—12FFFF	ON	ON	ON	OFF	ON	ON	OFF	ON
130000—13FFFF	ON	ON	ON	OFF	ON	ON	OFF	OFF
140000—14FFFF	ON	ON	ON	OFF	ON	OFF	ON	ON
150000—15FFFF	ON	ON	ON	OFF	ON	OFF	ON	OFF
160000—16FFFF	ON	ON	ON	OFF	ON	OFF	OFF	ON
170000—17FFFF	ON	ON	ON	OFF	ON	OFF	OFF	OFF
180000—18FFFF	ON	ON	ON	OFF	OFF	ON	ON	ON
190000—19FFFF	ON	ON	ON	OFF	OFF	ON	ON	OFF
1A0000—1AFFFF	ON	ON	ON	OFF	OFF	ON	OFF	ON
1B0000—1BFFFF	ON	ON	ON	OFF	OFF	ON	OFF	OFF
1C0000—1CFFFF	ON	ON	ON	OFF	OFF	OFF	ON	ON
1D0000—1DFFFF	ON	ON	ON	OFF	OFF	OFF	ON	OFF
1E0000—1EFFFF	ON	ON	ON	OFF	OFF	OFF	OFF	ON
1F0000—1FFFFF	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
200000—20FFFF	ON	ON	OFF	ON	ON	ON	ON	ON
210000—21FFFF	ON	ON	OFF	ON	ON	ON	ON	OFF
220000—22FFFF	ON	ON	OFF	ON	ON	ON	OFF	ON
230000—23FFFF	ON	ON	OFF	ON	ON	ON	OFF	OFF
240000—24FFFF	ON	ON	OFF	ON	ON	OFF	ON	ON
250000—25FFFF	ON	ON	OFF	ON	ON	OFF	ON	OFF
260000—26FFFF	ON	ON	OFF	ON	ON	OFF	OFF	ON
270000—27FFFF	ON	ON	OFF	ON	ON	OFF	OFF	OFF
280000—28FFFF	ON	ON	OFF	ON	OFF	ON	ON	ON
290000—29FFFF	ON	ON	OFF	ON	OFF	ON	ON	OFF
2A0000—2AFFFF	ON	ON	OFF	ON	OFF	ON	OFF	ON
2B0000—2BFFFF	ON	ON	OFF	ON	OFF	ON	OFF	OFF
2C0000—2CFFFF	ON	ON	OFF	ON	OFF	OFF	ON	ON
2D0000—2DFFFF	ON	ON	OFF	ON	OFF	OFF	ON	OFF
2E0000—2EFFFF	ON	ON	OFF	ON	OFF	OFF	OFF	ON
2F0000—2FFFFF	ON	ON	OFF	ON	OFF	OFF	OFF	OFF

\* Default (factory) controller memory starting address

DS1 CONTROLLER MEMORY STARTING ADDRESS SETTINGS (Cont'd)								
(See Figure A-2)								
ADDRESS (Hexadecimal)	SWITCH POSITIONS							
	8 (A23)	7 (A22)	6 (A21)	5 (A20)	4 (A19)	3 (A18)	2 (A17)	1 (A16)
3F0000—3FFFFFF	ON	ON	OFF	OFF	ON	ON	ON	ON
C00000—C0FFFF	OFF	OFF	ON	ON	ON	ON	ON	ON
C10000—C1FFFF	OFF	OFF	ON	ON	ON	ON	ON	OFF
C20000—C2FFFF	OFF	OFF	ON	ON	ON	ON	OFF	ON
C30000—C3FFFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF
C40000—C4FFFF	OFF	OFF	ON	ON	ON	OFF	ON	ON
C50000—C5FFFF	OFF	OFF	ON	ON	ON	OFF	ON	OFF
C60000—C6FFFF	OFF	OFF	ON	ON	ON	OFF	OFF	ON
C70000—C7FFFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF
C80000—C8FFFF	OFF	OFF	ON	ON	OFF	ON	ON	ON
C90000—C9FFFF	OFF	OFF	ON	ON	OFF	ON	ON	OFF
CA0000—CAFFFF	OFF	OFF	ON	ON	OFF	ON	OFF	ON
CB0000—CBFFFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF
CC0000—CCFFFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON
CD0000—CDFFFF	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
CE0000—CEFFFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON
CF0000—CFFFFFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
D00000—D0FFFF	OFF	OFF	ON	OFF	ON	ON	ON	ON
D10000—D1FFFF	OFF	OFF	ON	OFF	ON	ON	ON	OFF
D20000—D2FFFF	OFF	OFF	ON	OFF	ON	ON	OFF	ON
D30000—D3FFFF	OFF	OFF	ON	OFF	ON	ON	OFF	OFF
D40000—D4FFFF	OFF	OFF	ON	OFF	ON	OFF	ON	ON
D50000—D5FFFF	OFF	OFF	ON	OFF	ON	OFF	ON	OFF
D60000—D6FFFF	OFF	OFF	ON	OFF	ON	OFF	OFF	ON
D70000—D7FFFF	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF
D80000—D8FFFF	OFF	OFF	ON	OFF	OFF	ON	ON	ON
D90000—D9FFFF	OFF	OFF	ON	OFF	OFF	ON	ON	OFF
DA0000—DAFFFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
DB0000—DBFFFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
DC0000—DCFFFF	OFF	OFF	ON	OFF	OFF	OFF	ON	ON
DD0000—DDFFFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
DE0000—DEFFFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
DF0000—DFFFFFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF

DS1 CONTROLLER MEMORY STARTING ADDRESS SETTINGS (Cont'd)								
(See Figure A-2)								
ADDRESS (Hexadecimal)	SWITCH POSITIONS							
	8 (A23)	7 (A22)	6 (A21)	5 (A20)	4 (A19)	3 (A18)	2 (A17)	1 (A16)
E00000—E0FFFF	OFF	OFF	OFF	ON	ON	ON	ON	ON
E10000—E1FFFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF
E20000—E2FFFF	OFF	OFF	OFF	ON	ON	ON	OFF	ON
E30000—E3FFFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
E40000—E4FFFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON
E50000—E5FFFF	OFF	OFF	OFF	ON	ON	OFF	ON	OFF
E60000—E6FFFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON
E70000—E7FFFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
E80000—E8FFFF	OFF	OFF	OFF	ON	OFF	ON	ON	ON
E90000—E9FFFF	OFF	OFF	OFF	ON	OFF	ON	ON	OFF
EA0000—EAFFFF	OFF	OFF	OFF	ON	OFF	ON	OFF	ON
EB0000—EBFFFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
EC0000—ECFFFF	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
ED0000—EDFFFF	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
EE0000—EEFFFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
EF0000—EFFFFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
F00000—F0FFFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON
F10000—F1FFFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF
F20000—F2FFFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON
F30000—F3FFFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF
F40000—F4FFFF	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
F50000—F5FFFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF
F60000—F6FFFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON
F70000—F7FFFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
F80000—F8FFFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
F90000—F9FFFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF
FA0000—FAFFFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON
FB0000—FBFFFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
FC0000—FCFFFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
FD0000—FDFFFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
FE0000—FEFFFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
FF0000—FFFFFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

---

## DS1 Switch Settings—I/O Port Address

The factory set I/O port address (hexadecimal) is 100h. (The **h** is used to denote a hexadecimal number.)

The Dual In-line Package (DIP) switch designated DS1, SW11 through SW9 selects the port address of the output ports. The address must be set such that it does not conflict with other I/O addresses in the PC system. This address must also be consistent with the software being used. Figure A-3 shows switch DS1, SW11 through SW9 with the I/O address set to the factory setting (100h).

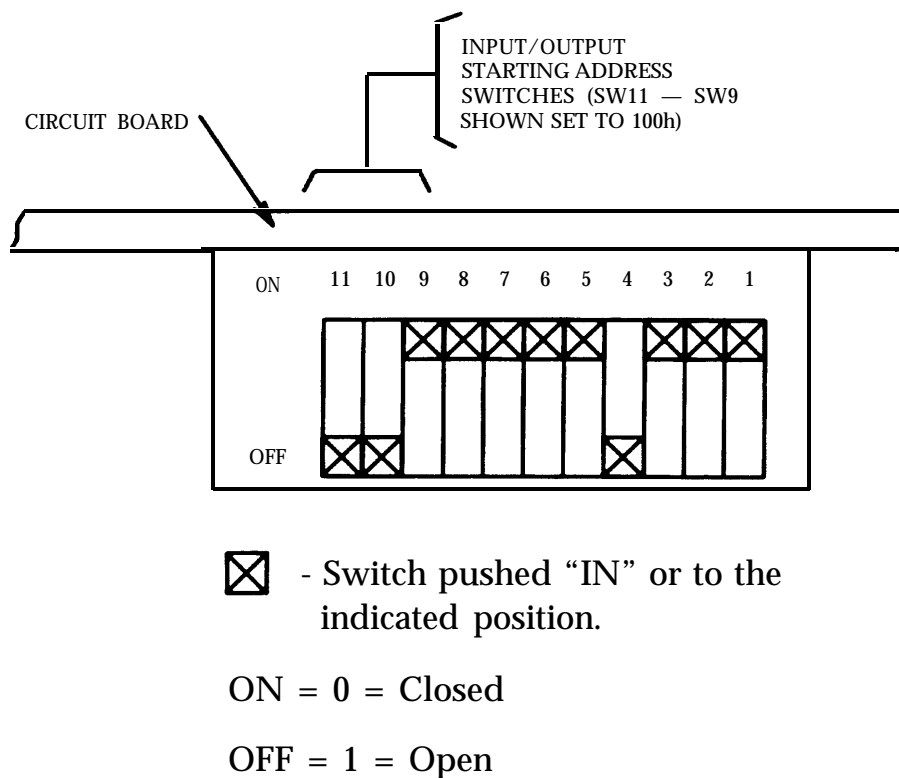


Figure A-3: DS1 Input/Output Port Address Switches (Default Setting)

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The following table shows the switch settings for the range of possible I/O port addresses.

DS1 INPUT/OUTPUT PORT ADDRESS SETTINGS (See Figure A-3)			
ADDRESS (Hexadecimal)	SWITCH POSITIONS		
	11	10	9
(Disabled)	OFF	OFF	OFF
<b>100*</b>	OFF	OFF	ON
110	OFF	ON	OFF
120	OFF	ON	ON
200	ON	OFF	OFF
220	ON	OFF	ON
300	ON	ON	OFF
320	ON	ON	ON

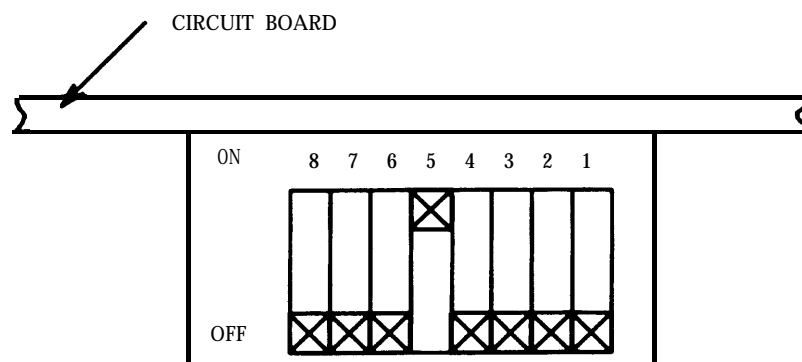
\* Default (factory) I/O port address

---

## DS2 Switch Settings—Interrupt Request Level

The Dual In-line Package (DIP) switch designated DS2, SW8 through SW1 select the IRQ level to be used by the IPC-1600 to interrupt the host processor. Only one of the eight switches is set to ON; the other seven switches must be set to OFF. At the factory, the hardware Interrupt ReQuest (IRQ) level is set to IRQ10.

One IRQ line can be assigned for each IPC-1600 or shared among all equipped IPC-1600s out of a total possible eight interrupts (IRQ3 through IRQ5, IRQ7, IRQ10 through IRQ12, and IRQ15). The IRQ7 interrupt request level is NOT recommended for use with the AT&T 6386 WGS computers. Figure A-4 shows DS2 in the factory set position (IRQ10).



☒ - Switch pushed "IN" or to the indicated position.

ON = 0 = Closed

OFF = 1 = Open

Figure A-4: DS2 Interrupt Request Level (Default Setting)

---

The following table shows the switch settings for the range of possible IRQ levels.

DS2 INTERRUPT REQUEST SWITCH SETTINGS (See Figure A-4)								
IRQ	SWITCH POSITION							
	8	7	6	5	4	3	2	1
IRQ3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
IRQ4	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
IRQ5	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
IRQ7	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
<b>IRQ10*</b>	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
IRQ11	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
IRQ12	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
IRQ15	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF

\* Default (factory) IRQ level



---

## Local Program Memory Size Select Jumper J1

Jumper J1 selects the size of the local program memory. This jumper is set at the factory to the correct position. The IPC-1600 has J1 set to 16KB (two 8Kx8 SRAM chips U1 and U2).

Local Program Memory Jumper Settings	
Memory Size	Jumper Positions
	J1
16KB	Pins 2 and 3
64KB	Pins 1 and 2

---

## Sample Configuration Record

A sample configuration record is provided in Figure A-5 as a job aid in recording installation information. Sample entries for two IPC-1600 are shown in Figure A-5.

SAMPLE CONFIGURATION RECORD							
BOARD ID	SLOT NUMBER	CONNECTOR TYPE	DATA TRANSFER TYPE	DMA CHANNEL	INPUT/OUTPUT ADDRESS	MEMORY ADDRESS RANGE	INTERRUPT REQUEST LEVEL
IPC-1600	03	AT	16-bit	None	100h	080000h—08FFFFh	10
IPC-1600	04	AT	16-bit	None	110h	080000h—08FFFFh	10

Figure A-5: Sample Configuration Record

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## Appendix B: Serial Input/Output Device Interface

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# Serial Port Characteristics

At the IPC-1600 RJ-45 type modular jack connectors, each serial port is configured as Data Terminal Equipment (DTE). To connect an I/O device (terminal or MODEM) to a serial port requires a 10-conductor or 8-conductor modular cable and the appropriate 10-pin or 8-pin modular to 25-pin connector adapter. Modular cables and adapters are ordered separately for the IPC-1600.

Each of the sixteen serial ports have the following characteristics.

- Output current is limited with 10 milliamperes being typical.
- Power-off output impedance is 300 ohms (minimum).
- Input resistance is 3K ohms to 7K ohms.
- Input voltage range is +30V to -30V.
- Input has built-in hysteresis (double thresholds).

---

# Voltage Envelope

The region between +3V and -3V is defined as the transition region and is considered an invalid level. A voltage more negative than -12V or more positive than +12V is also considered an invalid level.

During the transmission of data, the “marking” condition is used to denote the binary state “1” and the “spacing” condition is used to denote the binary state “0.” Figure B-1 shows the voltage envelope.

For interface control circuits, the function is “on” when the voltage is more positive than +3V with respect to the signal ground. The function is “off” when the voltage is more negative than -3V with respect to signal ground.

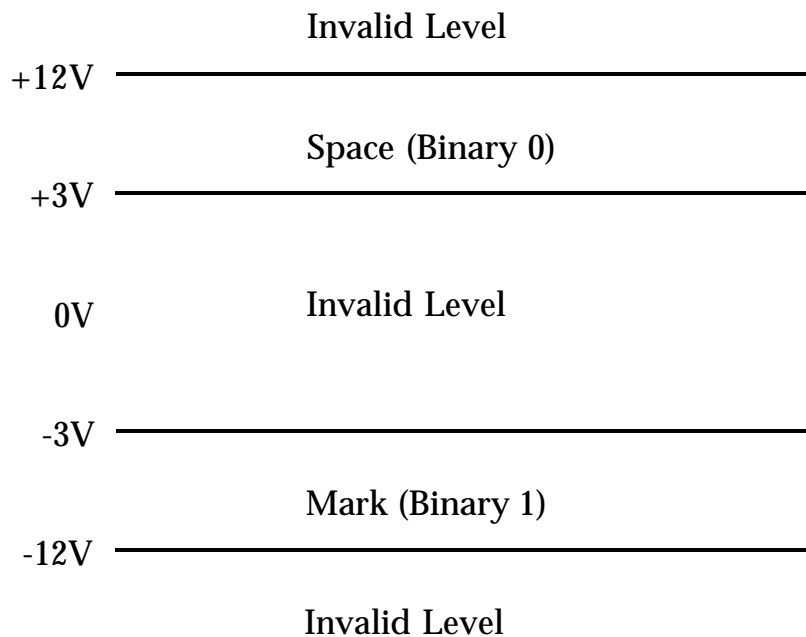


Figure B-1: RS-232C Voltage Envelope

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## IPC-1600 80-Pin Headers P3 and P4

P3 and P4 are each eighty-pin, right-angle headers. The 16-Ports Fanout Module ribbon cables connect to these headers as shown in Figure B-2.

Connector P4 is used for ports 1 through 8; connector P3 is used for ports 9 through 16. The 16-Ports Fanout Module cable assembly has two 80-conductor ribbon cables. Cable “P4” connects to header P4 (ports 1 through 8); cable “P3” connects to header P3 (ports 9 through 16).

The following table shows the signal and pin assignments for connectors P3 and P4.

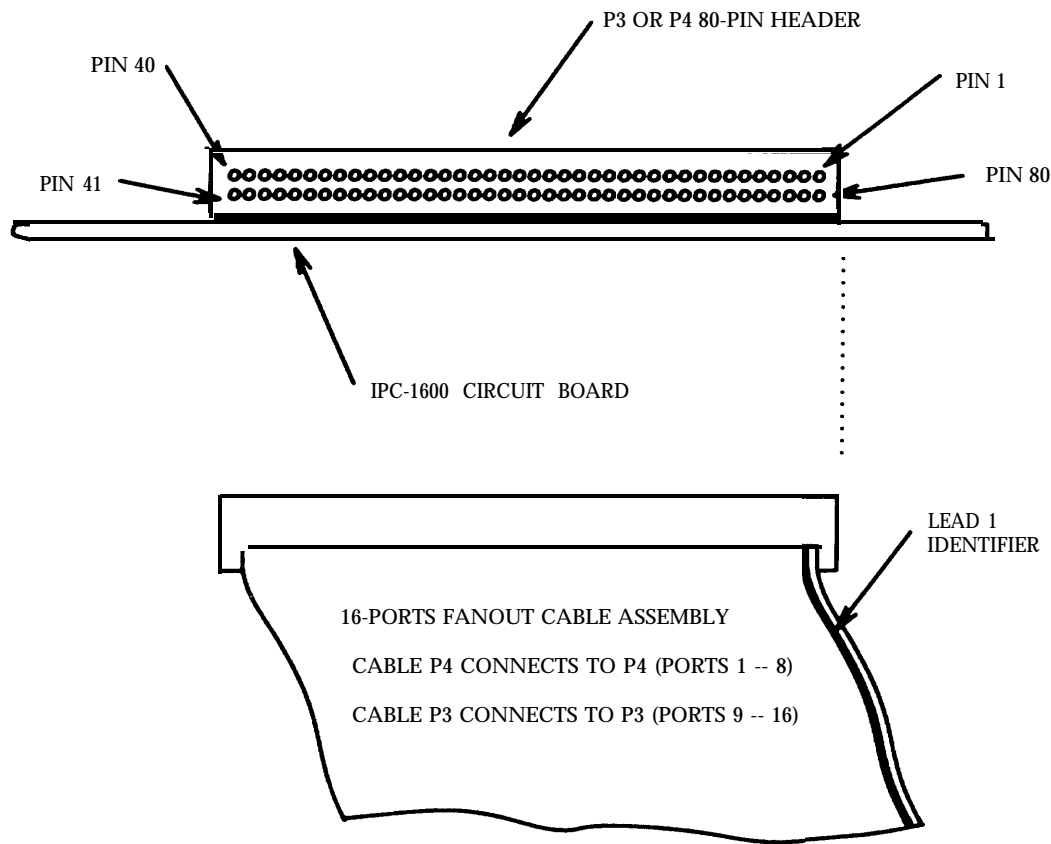


Figure B-2: 80-Pin Headers P3 and P4 Connector Pin Identification

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IPC-1600 80-PIN HEADERS		
PIN	SIGNAL NAME	
NUMBER	P4 CONNECTOR	P3 CONNECTOR
01	Data Terminal Ready 7 (DTR7)	Data Terminal Ready 15 (DTR15)
02	Request To Send 5 (RTS5)	Request To Send 13 (RTS13)
03	Request To Send 7 (RTS7)	Request To Send 15 (RTS15)
04	Ring indicator 7 (RI7)	Ring Indicator 15 (RI15)
05	Clear To Send 8 (CTS8)	Clear To Send 16 (CTS16)
06	Data Terminal Ready 5 (DTR5)	Data Terminal Ready 13 (DTR13)
07	Data Carrier Detect 6 (DCD6)	Data Carrier Detect 14 (DCD14)
08	Clear To Send 5 (CTS5)	Clear To Send 13 (CTS13)
09	Data Carrier Detect 7 (DCD7)	Data Carrier Detect 15 (DCD15)
10	Receive Data 6 (RD6)	Receive Data 14 (RD14)
11	Data Carrier Detect 8 (DCD8)	Data Carrier Detect 16 (DCD16)
12	Clear To Send 7 (CTS7)	Clear To Send 15 (CTS15)
13	Clear To Send 6 (CTS6)	Clear To Send 14 (CTS14)
14	Receive Data 8 (RD8)	Receive Data 16 (RD16)
15	Data Carrier Detect 5 (DCD5)	Data Carrier Detect 13 (DCD13)
16	Receive Data 7 (RD7)	Receive Data 15 (RD15)
17	Request To Send 8 (RTS8)	Request To Send 16 (RTS16)
18	Receive Data 5 (RD5)	Receive Data 13 (RD13)
19	Data Terminal Ready 8 (DTR8)	Data Terminal Ready 16 (DTR16)
20	Data Set Ready 5 (DSR5)	Data Set Ready 13 (DSR13)
21	Transmit Data 5 (TD5)	Transmit Data 13 (TD13)
22	Data Set Ready 7 (DSR7)	Data Set Ready 15 (DSR15)
23	Transmit Data 7 (TD7)	Transmit Data 15 (TD15)
24	Data Set Ready 8 (DSR8)	Data Set Ready 16 (DSR16)
25	Ring Indicator 8 (RI8)	Ring Indicator 16 (RI16)
26	Ground (GND)	Ground (GRD)
27	Data Set Ready 6 (DSR6)	Data Set Ready 14 (DSR14)
28	Ground (GND)	Ground (GRD)
29	Transmit Data 8 (TD8)	Transmit Data 16 (TD16)
30	Ground (GND)	Ground (GRD)
31	Request To Send 6 (RTS6)	Request To Send 14 (RTS14)
32	Ground (GND)	Ground (GRD)
33	Ring Indicator 5 (RI5)	Ring Indicator 13 (RI13)
34	Ground (GND)	Ground (GRD)
35	Ring Indicator 6 (RI6)	Ring Indicator 14 (RI14)
36	Ground (GND)	Ground (GRD)
37	Transmit Data 6 (TD6)	Transmit Data 14 (TD14)
38	Ground (GND)	Ground (GRD)
39	Data Terminal Ready 6 (DTR6)	Data Terminal Ready 14 (DTR14)
40	Ground (GND)	Ground (GRD)

IPC-1600 80-PIN CONNECTORS (Cont'd)		
PIN NUMBER	SIGNAL NAME	
	P4 CONNECTOR	P3 CONNECTOR
41	Data Terminal Ready 3 (DTR3)	Data Terminal Ready 11 (DTR11)
42	Ground (GND)	Ground (GRD)
43	Request To Send 3 (RTS3)	Request To Send 11 (RTS11)
44	Ground (GND)	Ground (GRD)
45	Ring Indicator 4 (RI4)	Ring Indicator 12 (RI12)
46	Ground (GND)	Ground (GRD)
47	Ring Indicator 3 (RI3)	Ring Indicator 11 (RI11)
48	Ground (GND)	Ground (GRD)
49	Data Set Ready 1 (DSR1)	Data Set Ready 9 (DSR9)
50	Ground (GND)	Ground (GRD)
51	Receive Data 1 (RD1)	Receive Data 9 (RD9)
52	Ground (GND)	Ground (GRD)
53	Clear To Send 3 (CTS3)	Clear To Send 11 (CTS11)
54	Ground (GND)	Ground (GRD)
55	Clear To Send 1 (CTS1)	Clear To Send 9 (CTS9)
56	Ground (GND)	Ground (GRD)
57	Clear To Send 4 (CTS4)	Clear To Send 12 (CTS12)
58	Data Set Ready 3 (DSR3)	Data Set Ready 11 (DSR11)
59	Data Carrier Detect 4 (DCD4)	Data Carrier Detect 12 (DCD12)
60	Receive Data 3 (RD3)	Receive Data 11 (RD11)
61	Ring Indicator 1 (RI1)	Ring Indicator 9 (RI9)
62	Data Set Ready 2 (DSR2)	Data Set Ready 10 (DSR10)
63	Ring Indicator 2 (RI2)	Ring Indicator 10 (RI10)
64	Receive Data 2 (RD2)	Receive Data 10 (RD10)
65	Request To Send 4 (RTS4)	Request To Send 12 (RTS12)
66	Clear To Send 2 (CTS2)	Clear To Send 10 (CTS10)
67	Transmit Data 3 (TD3)	Transmit Data 11 (TD11)
68	Data Carrier Detect 2 (DCD2)	Data Carrier Detect 10 (DCD10)
69	Request To Send 1 (RTS1)	Request To Send 9 (RTS9)
70	Transmit Data 2 (TD2)	Transmit Data 10 (TD10)
71	Data Terminal Ready 4 (DTR4)	Data Terminal Ready 12 (DTR12)
72	Request To Send 2 (RTS2)	Request To Send 10 (RTS10)
73	Data Terminal Ready 2 (DTR2)	Data Terminal Ready 10 (DTR10)
74	Transmit Data 1 (TD1)	Transmit Data 9 (TD9)
75	Transmit Data 4 (TD4)	Transmit Data 12 (TD12)
76	Data Terminal Ready 1 (DTR1)	Data Terminal Ready 9 (DTR9)
77	Receive Data 4 (RD4)	Receive Data 12 (RD12)
78	Data Carrier Detect 3 (DCD3)	Data Carrier Detect 11 (DCD11)
79	Data Set Ready 7 (DSR7)	Data Set Ready 15 (DSR15)
80	Data Carrier Detect 1 (DCD1)	Data Carrier Detect 9 (DCD9)

---

## 16-Ports Fanout Module Assembly

The 16-Ports Fanout Module Assembly provides sixteen RJ-45 type, 10-pin modular jack connectors. Two 80-conductor ribbon cables connect the modular jack connectors to the two 80-pin headers (P3 and P4) on the IPC-1600 board. Figure B-3 shows the 16-Ports Fanout Module Assembly. Cable/header signal and pin information is described previously in the “IPC-1600 80-pin Headers P3 and P4” section. The RJ-45 type connectors signal and pin information is provided later in the “RJ-45 Type Modular Jack Connector” section.

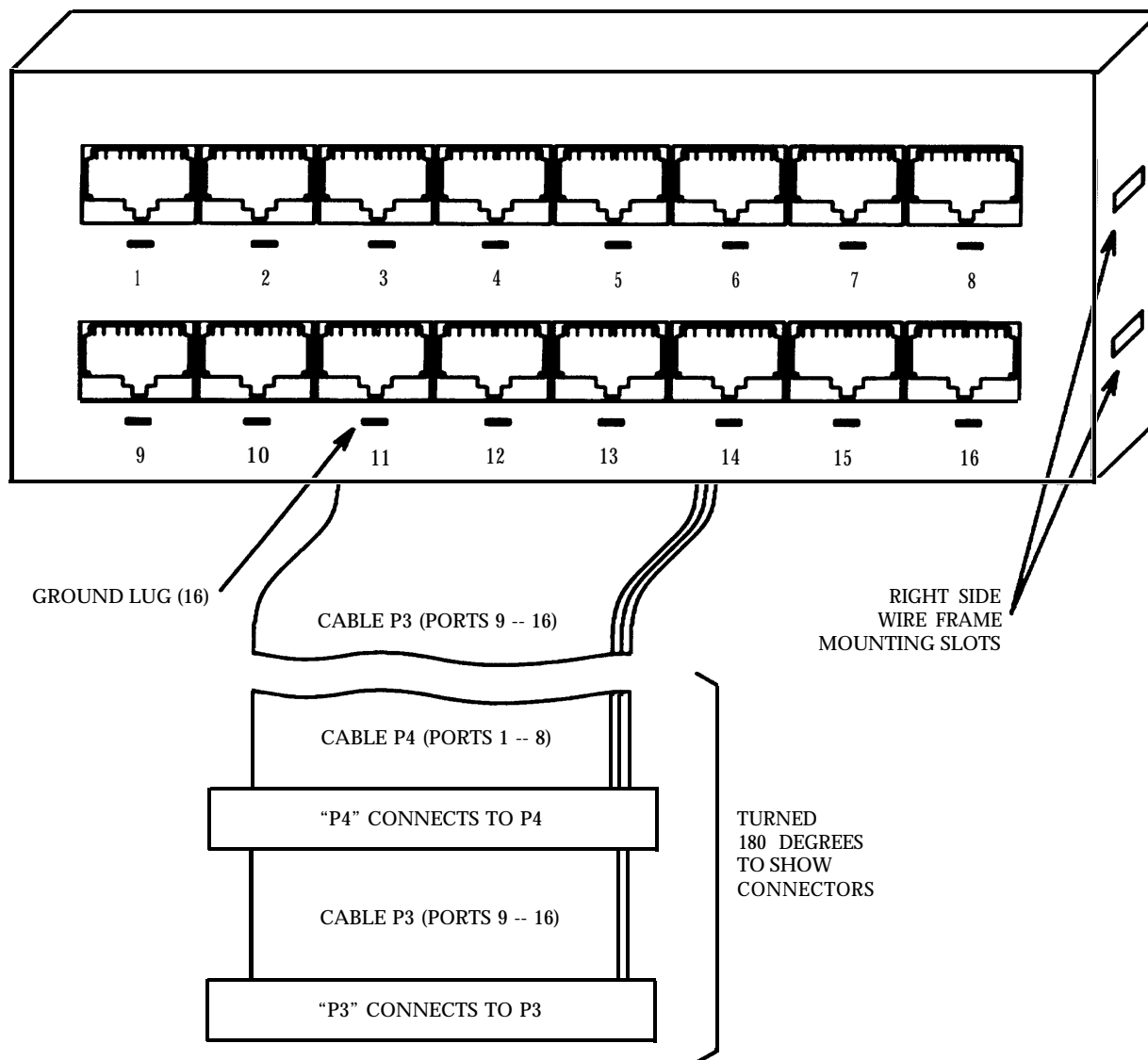


Figure B-3: 16-Ports Fanout Module Assembly

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# RJ-45 Type Modular Jack Connector

Figure B-4 identifies the RJ-45 type modular jack connector pins used on the 16-port fanout module assembly. Signal flow is identified with respect to the IPC-1600.

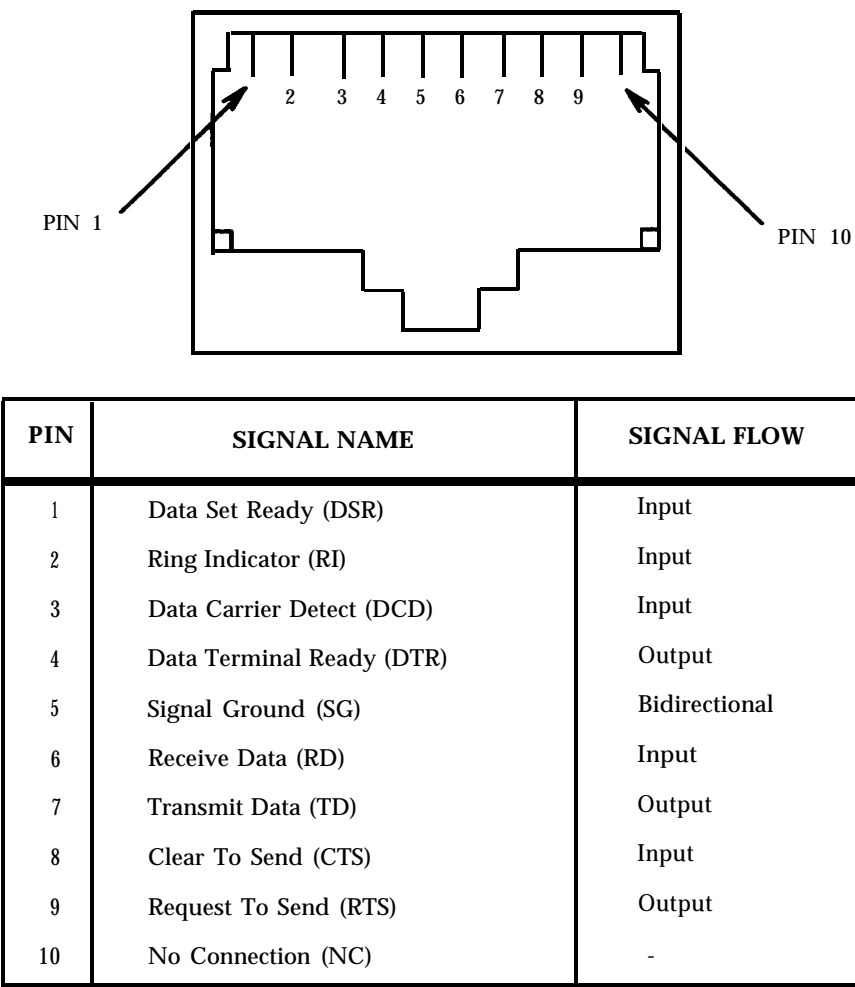


Figure B-4: RJ-45 Type Modular Jack Connector Pin Identification

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# Data Terminal Equipment (DTE) Connections

## Overview

AT&T adapters are separately orderable for connecting the 10-pin IPC-1600 serial I/O ports to serial printers and I/O devices configured as Data Terminal Equipment (DTE). AT&T adapters are also available for connecting equipment to the host system DB-9 integral port. Each of these adapters is described in this section.

## AT&T Null MODEM Adapter

The AT&T Null MODEM Adapter (COMCODE 846362788) is an RJ-45 (10) to female DB-9 DTE connector. It provides for the connection of an IPC-1600 serial port with other equipment having a male DB-9 connector matching the interface shown in Figure B-5. Figure B-5 shows the connection diagram of the AT&T Null MODEM Adapter.

## AT&T Straight Thru Adapter

The AT&T Straight Thru Adapter (COMCODE 846373413) is an RJ-45 (10) to female DB-9 connector. It is used to connect an integral DB-9 serial port (COM1 or COM2) to an 8- or 10-conductor modular cable. A male DB-25, Data Circuit-terminating Equipment (DCE), AT&T Remote Console Adapter or a male AT&T ACU/MODEM (DCE) Adapter can be used at the other end of the modular cable to connect the host DB-9 integral port to a MODEM. The AT&T Remote Console Adapter enables remote users or system administrators to remain connected to the host system during system resets and reboots. Figure B-6 shows the connection diagram of the AT&T Straight Thru Adapter.

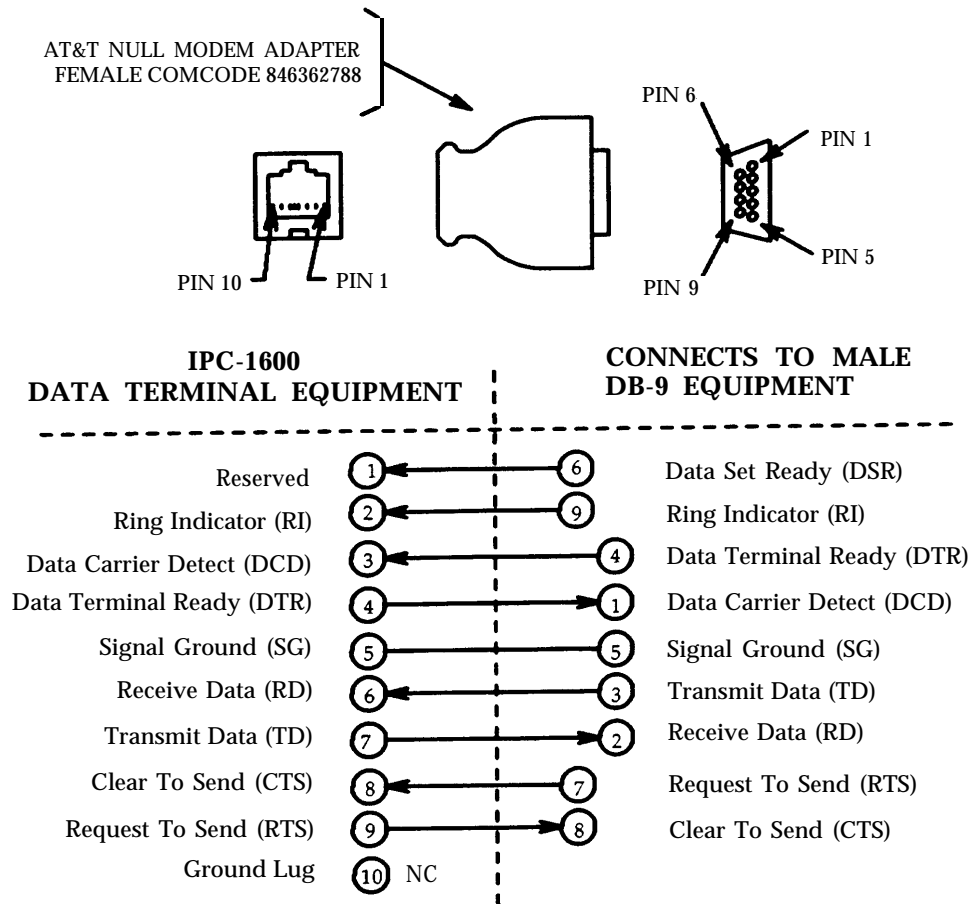
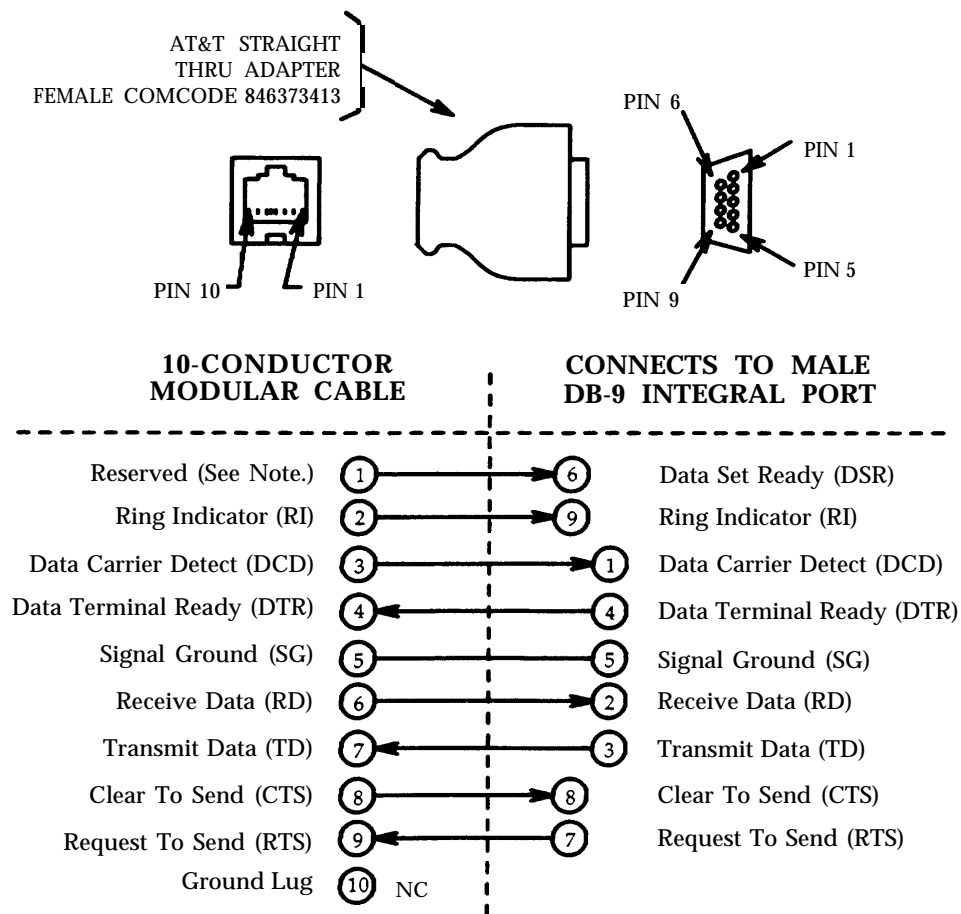


Figure B-5: AT&T Null MODEM Adapter Connection Diagram

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**Note:** The “Reserved” connection can be used to provide Data Set Ready (DSR) when this adapter is used with either an AT&T ACU/MODEM adapter or an AT&T Remote Console adapter.

Figure B-6: AT&T Straight Thru Adapter Connection Diagram



## 10-Pin to DB-25 DTE Adapters

### AT&T Terminal/Printer Adapters

The AT&T Terminal/Printer Adapter is an RJ-45 (10) to DB-25 DTE connector. Both male (COMCODE 846362739) and female (COMCODE 846362747) RJ-45 (10) to DB-25 versions of this adapter are available. Figure B-7 shows the connection diagram of the AT&T Terminal/Printer (DTE) Adapter.

### AT&T Printer (DTR) Adapter

The AT&T Printer (DTR) Adapter (COMCODE 846373405) is an RJ-45 (10) to male DB-25 DTE connector. It is used to connect devices using Data Terminal Ready (DTR) assertion for flow control. Figure B-8 shows the connection diagram of the AT&T Printer (DTR) Adapter.

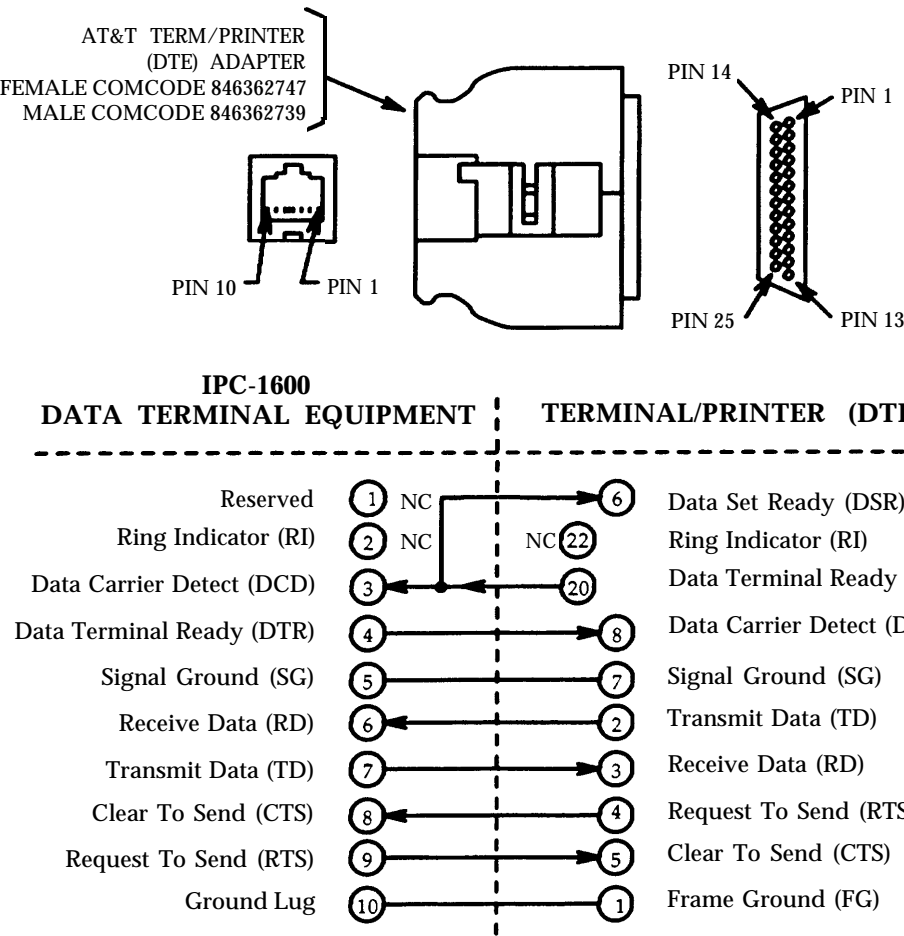


Figure B-7: AT&T Terminal/Printer Adapter Connection Diagram

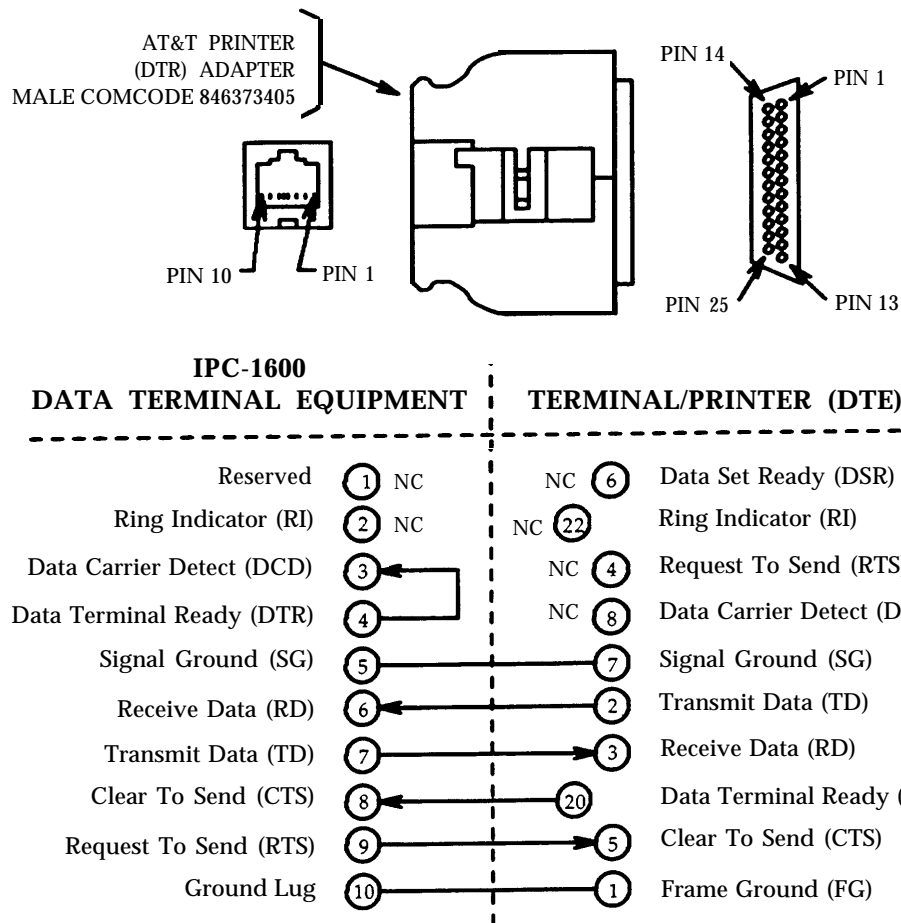


Figure B-8: AT&T Printer (DTR) Adapter Connection Diagram

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# Data Circuit-Terminating Equipment (DCE) Connections

## Overview

Adapters are separately orderable for connecting the 10-pin IPC-1600 serial I/O ports and the host system DB-25 integral port to serial printers, I/O terminals, and modems configured as Data Circuit-terminating Equipment (DCE).

## AT&T ACU/MODEM (DCE) Adapters

The AT&T ACU/MODEM (DCE) Adapter is an RJ-45 (10) to DB-25 DCE connector. Both male (COMCODE 846362754) and female (COMCODE 846362762) RJ-45 (10) to DB-25 versions of this adapter are available. Figure B-9 shows the connection diagram of the AT&T ACU/MODEM (DCE) Adapter. This adapter is used to connect an IPC-1600 serial port to a terminal/printer or Automatic Calling Unit (ACU)/MODEM configured as DCE.

## AT&T Remote Console Adapter

The AT&T Remote Console Adapter (COMCODE 846362770) is an RJ-45 (10) to male DB-25 connector. The AT&T Remote Console Adapter provides the signal connections necessary to stay in communication with the host system when the host system reboots or resets. Figure B-10 shows the connection diagram of the AT&T Remote Console Adapter. Note that a 10 pin to female DB-25 AT&T ACU/MODEM (DCE) Adapter is used at the host system integral port to connect to the 10-conductor modular cable. The AT&T Remote Console Adapter connects the modular cable to an ACU/MODEM. The AT&T Remote Console Adapter can also be used with a 10-conductor modular cable to connect an IPC-1600 serial port to an ACU/MODEM or other DCE having a need for the special features of this adapter.

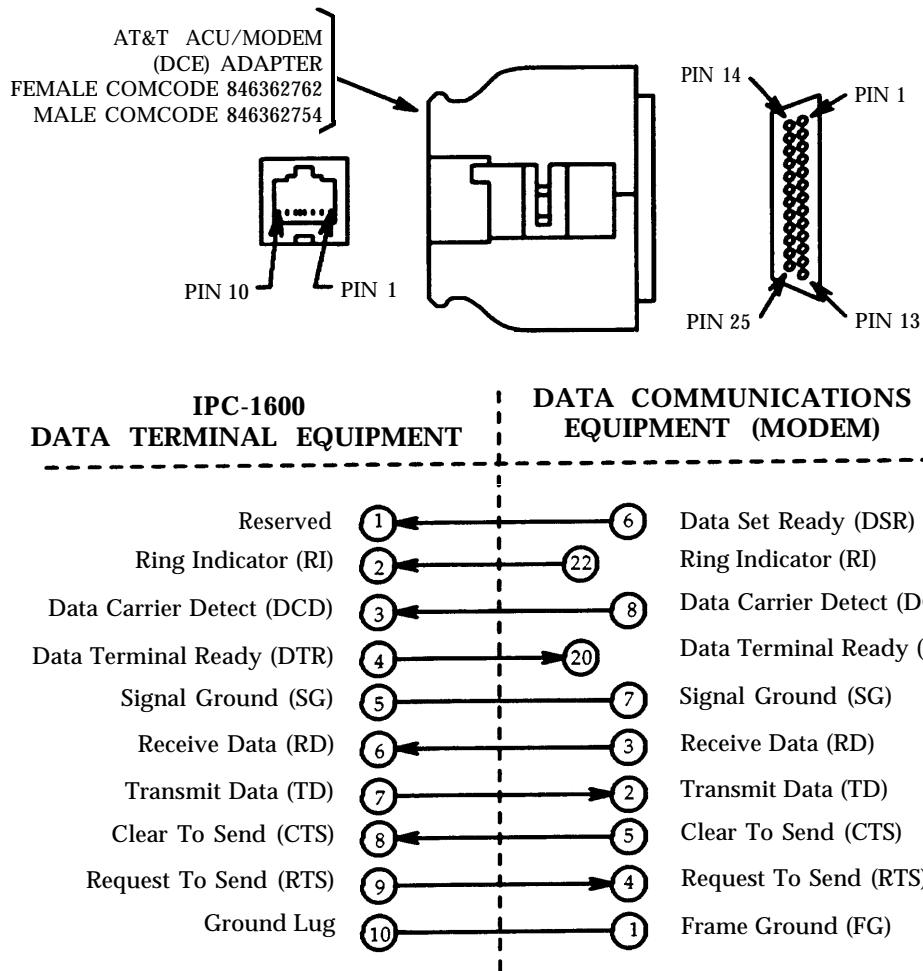
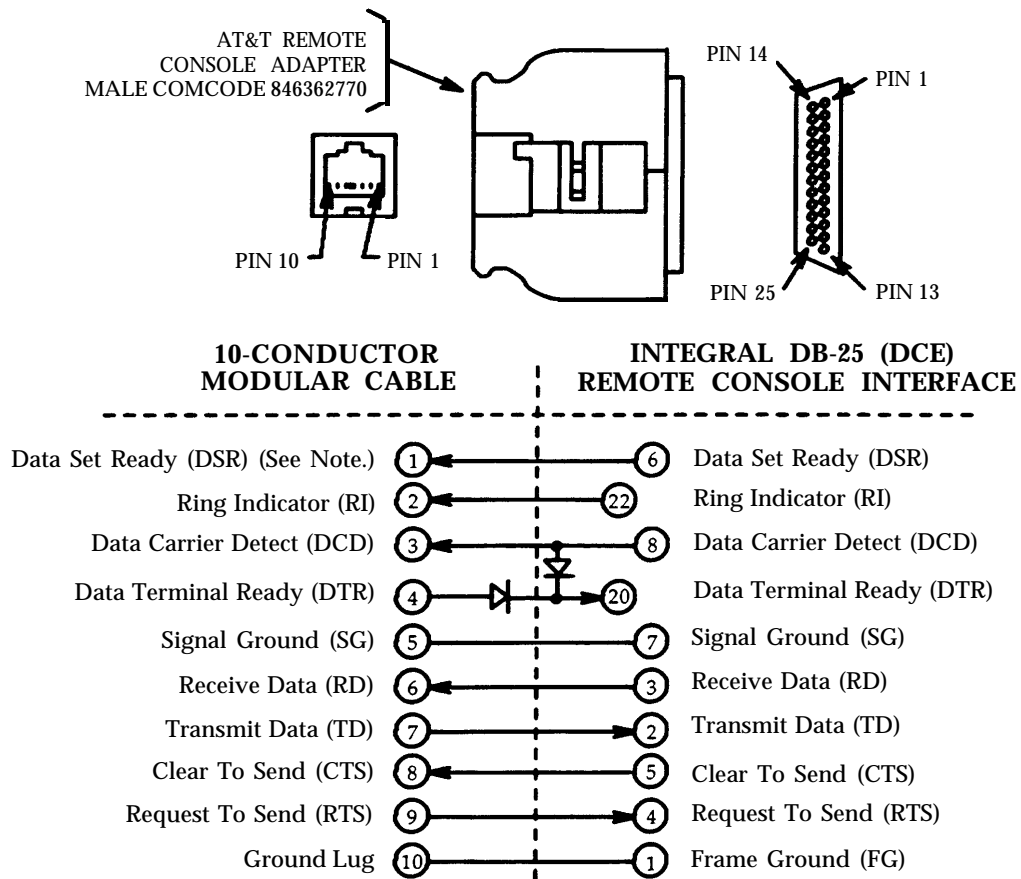


Figure B-9: AT&T ACU/MODEM (DCE) Adapter Connection Diagram

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**Note:** Data Set Ready (DSR) is provided and recognized when connecting to the host system integral serial port.

Figure B-10: AT&T Remote Console Adapter Connection Diagram

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## 10-Conductor Modular Cables

The 10-conductor modular cables are separately orderable in the following lengths:

- 10-foot cable (COMCODE 846362705)
- 25-foot cable (COMCODE 846362713)
- 50-foot cable (COMCODE 846362721)

The pinouts for these connectorized cables are shown in Figure B-11.

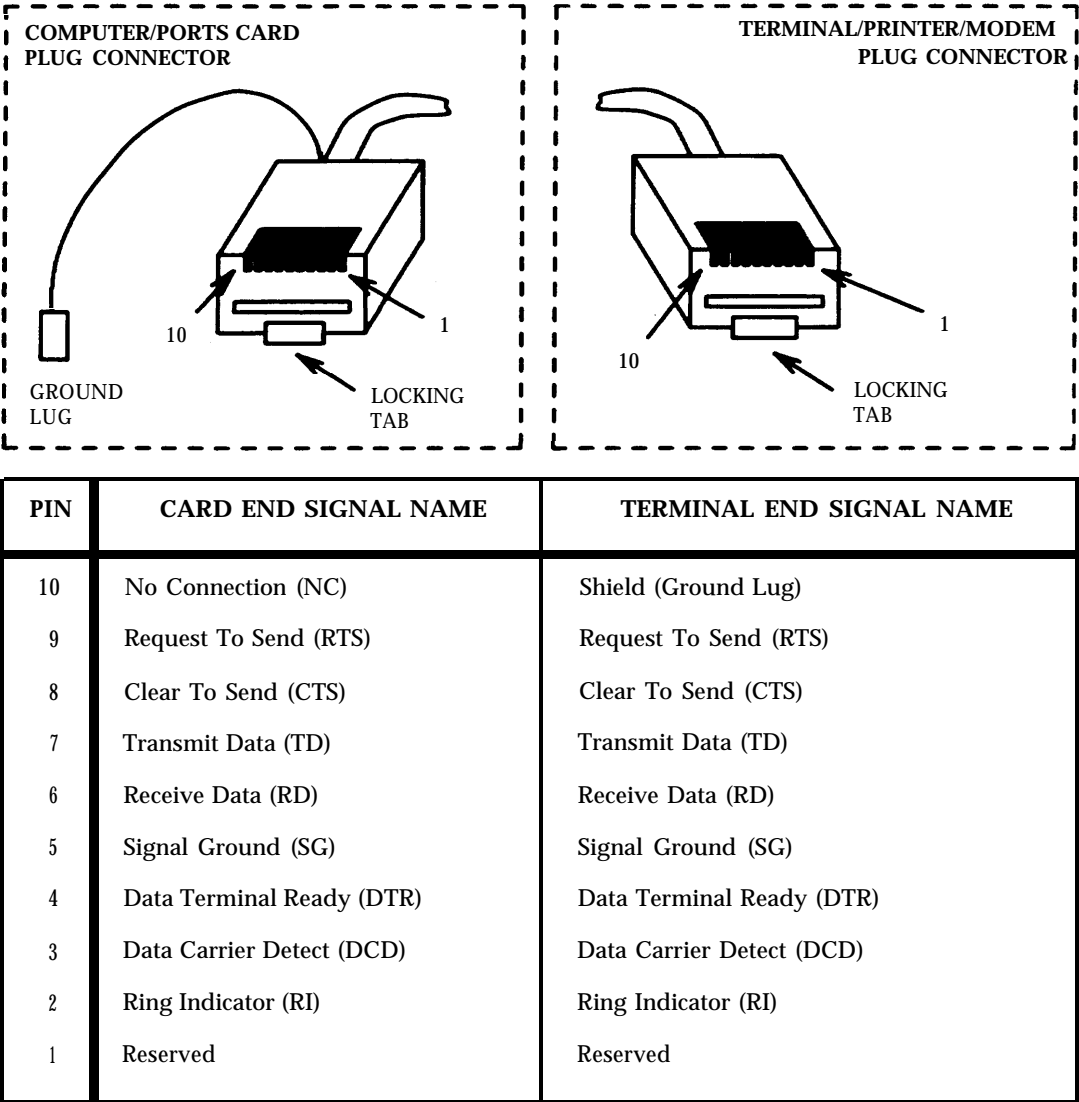


Figure B-11: 10-Conductor Modular Cable Connector Pin Identification

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# AT&T 10-Pin Extender Adapter

The AT&T 10-Pin Extender Adapter (COMCODE 846362804) is an RJ-45 (10) to RJ-45 (10) connector. It is used to connect to lengths of 10-conductor modular cable. Limitations on cable length are application dependent. Figure B-12 shows a connection diagram of this adapter. This adapter is separately orderable.

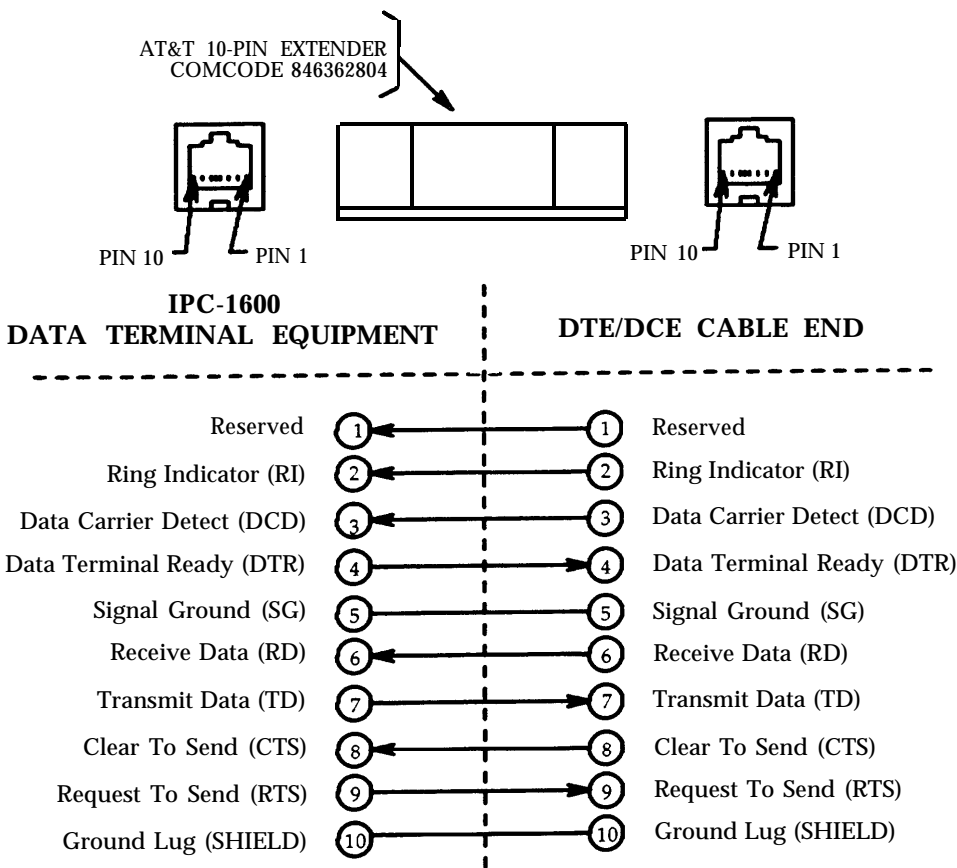


Figure B-12: AT&T 10-Pin Extender Adapter Connection Diagram

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# Compatibility with Other I/O System Cabling

## Overview

To protect the investment in existing systems and cabling, provisions have been made to use the existing system cables and connectors with the IPC-1600. The existing cabling is used along with the appropriate IPC-1600 modular cables and adapters (previously described) to connect an IPC-1600 to the existing cabling system. This section provides specific information for connecting the IPC-1600 serial ports to the following environments:

- Intelligent Ports Card Model 802 (IPC-802) Interface
- 3B2 Computer PORTS/EPORTS Interface.

## Intelligent Ports Card Model 802 (IPC-802) Interface

When an IPC-1600 replaces an IPC-802, the existing serial I/O cables are used along with 8-conductor or new 10-conductor modular cables and associated adapters to provide the serial I/O connections. Figure B-13 shows how to connect IPC-1600 serial ports to existing IPC-802 I/O system cabling. An IPC-1600 serial port is connected to the existing male DB-25 connector using a 10-conductor modular cable and an RJ-45 (10) to female DB-25 AT&T ACU/MODEM (DCE) Adapter. The existing IPC-802 connector must be selected such that the signals interface correctly.

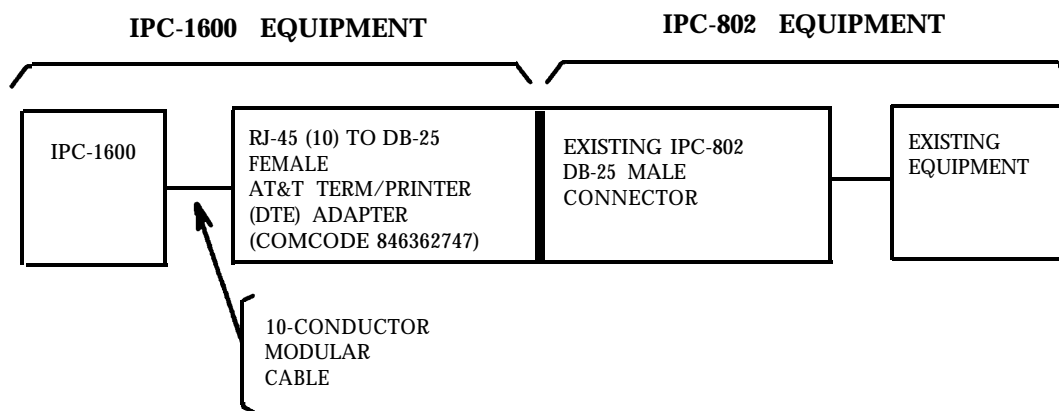


Figure B-13: IPC-1600 Connection to Existing IPC-802.Cabling

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## 3B2 Computer PORTS/EPORTS Interface

**Caution:** Do NOT plug a 3B2 computer cross-over modular RJ-45 cable directly into the IPC-1600 RJ-45 receptacle (jack) connector. Inserting a 3B2 computer modular cable directly into an IPC-1600 jack does not provide RS-232C communication. Appropriate RJ-45 to DB-25 adapters must be used to provide proper RS-232C communication. See Figure B-13.

When an IPC-1600 replaces a 3B2 computer PORTS or EPORTS card, the existing serial I/O cables are used along with straight-through 10-conductor or 8-conductor modular cables and associated adapters to provide the serial I/O connections. Figure B-14 shows how to connect IPC-1600 serial ports to existing 3B2 computer PORTS/EPORTS I/O system cabling. An IPC-1600 serial port is connected to the existing 3B2 computer 8-conductor cable using a terminal/printer adapter, ACU/MODEM adapter, and a 10-conductor modular cable. If an IPC-1600 AT&T ACU/MODEM (DCE) Adapter is used on the 10-conductor cable, the opposite gender 3B2 computer terminal/printer adapter is used on the 8-conductor modular cable (Figure B-14, Example A and Example B). Conversely, if a male ACU/MODEM adapter is used on the 8-conductor cable, a female AT&T Terminal/Printer (DTE) Adapter is used on the 10-conductor cable (Figure B-14, Example C).

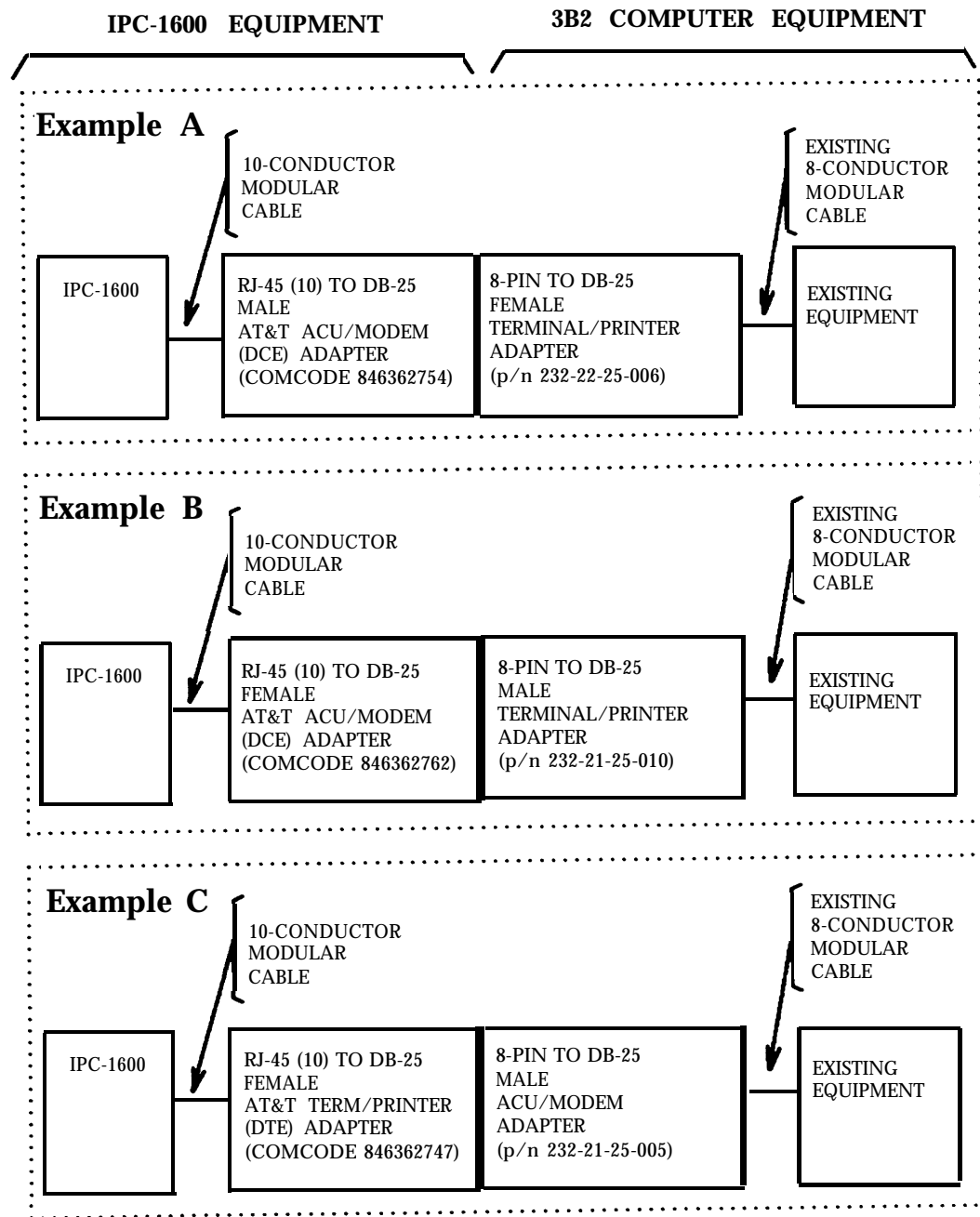


Figure B-14: IPC-1600 Connection to Existing 3B2 Computer  
PORTS/EPORTS Cabling

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# Adapter and Cable Ordering Information

The following table summarizes the adapters and cables available for use with the IPC-1600 and identifies the COMCODES and Price Element Codes (PECs). Contact your AT&T Sales Representative or authorized dealer for additional information.

EQUIPMENT DESCRIPTION	COMCODE	PEC	LABEL	FIG.
<b>Modular Cables and Cable Extender</b>				
10-foot, 10- Conductor Modular Cable	846362705	37776	AT&T	B-11
25-foot, 10- Conductor Modular Cable	846362713	37778	AT&T	B-11
50-foot, 10- Conductor Modular Cable	846362721	37780	AT&T	B-11
RJ-45 (10) to RJ-45 (10) Straight (1-1) In-Line Extender	846362804	37796	AT&T 10 PIN EXTENDER	B-12
<b>Integral Port Adapters</b>				
RJ-45 (10) to Female DB-9 DTE	846362788	37792	AT&T NULL MODEM ADAPTER	B-5
RJ-45 (10) to Female DB-9 DTE	846373413	37802	AT&T STRAIGHT THRU ADAPTER	B-6
<b>Remote Console Adapter</b>				
RJ-45 (10) to Male DB-25 DCE	846362770	37790	AT&T REMOTE CONSOLE	B-10
<b>Terminal/Printer Adapters</b>				
RJ-45 (10) to Female DB-25 DTE	846362747	37784	AT&T TERM/PRINTER (DTE)	B-7
RJ-45 (10) to Male DB-25 DTE	846362739	37782	AT&T TERM/PRINTER (DTE)	B-7
RJ-45 (10) to Male DB-25 DTE DTR Hardware Flow Control	846373405	37800	AT&T PRINTER (DTR)	B-8
<b>ACU/MODEM Adapters</b>				
RJ-45 (10) to Male DB-25 DCE	846362754	37786	AT&T ACU/MODEM (DCE)	B-9
RJ-45 (10) to Female DB-25 DCE	846362762	37788	AT&T ACU/MODEM (DCE)	B-9

# Adapter Use Information

The following table identifies the appropriate AT&T adapter for connecting certain equipment to a serial port on the IPC-1600.

CONNECTING EQUIPMENT		AT&T ADAPTER		
DEVICE	DESCRIPTION	COMCODE	DESCRIPTION	FIG.
Character Display Terminal	605	846362739	Male DB-25 (DTE)	B-7
	610	846362739	Male DB-25 (DTE)	B-7
	615	846362739	Male DB-25 (DTE)	B-7
	615C	846362739	Male DB-25 (DTE)	B-7
	4410	846362739	Male DB-25 (DTE)	B-7
	4425	846362739	Male DB-25 (DTE)	B-7
	5410	846362739	Male DB-25 (DTE)	B-7
	5420	846362739	Male DB-25 (DTE)	B-7
	5425	846362739	Male DB-25 (DTE)	B-7
Graphics Display Terminal	620	846362739	Male DB-25 (DTE)	B-7
	630	846362739	Male DB-25 (DTE)	B-7
Integrated Voice Data Terminal	510A	846362754	Male DB-25 (DCE)	B-9
Dial-Up MODEM	2212C	846362754	Male DB-25 (DCE)	B-9
	2224B	846362754	Male DB-25 (DCE)	B-9
	2224CEO	846362754	Male DB-25 (DCE)	B-9
	2224G	846362754	Male DB-25 (DCE)	B-9
	2248A	846362754	Male DB-25 (DCE)	B-9
	2248C	846362754	Male DB-25 (DCE)	B-9
	2248T	846362754	Male DB-25 (DCE)	B-9
	2296A	846362754	Male DB-25 (DCE)	B-9
	4000	846362754	Male DB-25 (DCE)	B-9
	4024	846362754	Male DB-25 (DCE)	B-9

CONNECTING EQUIPMENT		AT&T ADAPTER		
DEVICE	DESCRIPTION	COMCODE	DESCRIPTION	FIG.
AT&T PARADYNE MODEM	222	846362754	Male DB-25 (DCE)	B-9
	224	846362754	Male DB-25 (DCE)	B-9
	DL424	846362754	Male DB-25 (DCE)	B-9
	DM424	846362754	Male DB-25 (DCE)	B-9
Daisy Wheel Printer	455 (Serial)	846362747	Female DB-25 (DTE)	B-7
	455 (Parallel)	Not Applicable	—	—
	457 (Parallel)	Not Applicable	—	—
Dot Matrix Printer	475 (Serial)	846362739	Male DB-25 (DTE)	B-7
	476 (Serial)	846362739	Male DB-25 (DTE)	B-7
	477 (Parallel)	Not Applicable	—	—
	477 (Serial)	846362739	Male DB-25 (DTE)	B-7
	478 (Parallel)	Not Applicable	—	—
	479 (Parallel)	Not Applicable	—	—
	570 (Parallel)	Not Applicable	—	—
	571 (Parallel)	Not Applicable	—	—
	572 (Serial)	846362739	Male DB-25 (DTE)	B-7
	573 (Serial)	846362739	Male DB-25 (DTE)	B-7
	580 (Parallel)	Not Applicable	—	—
	580 (Serial)	846362739	Male DB-25 (DTE)	B-7
	581 (Parallel)	Not Applicable	—	—
	581 (Serial)	846362739	Male DB-25 (DTE)	B-7
	583 (Parallel)	Not Applicable	—	—
	583 (Serial)	846362739	Male DB-25 (DTE)	B-7
Laser Printer	446 (Serial)	846362739	Male DB-25 (DTE)	B-7
	495 (Serial)	846362739	Male DB-25 (DTE)	B-7
	593 (Serial)	846362739	Male DB-25 DTE)	B-7
Line Printer	442 (Serial)	846362739	Male DB-25 (DTE)	B-7
	442 (Parallel)	Not Applicable	—	—
	444 (Serial)	846362739	Male DB-25 (DTE)	B-7
	444 (Parallel)	Not Applicable	—	—



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## Appendix C: AT&T IPC-1600 Ports Cabinet

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# General Description

## Purpose

The AT&T IPC-1600 Ports Cabinet (Figure C-1) is a wire-frame assembly providing mounting space for two 16-Ports Fanout modules (COMCODE 405977869). The cabinet can be placed on a table or floor or can be mounted on a wall or other stable surface. The wire-frame assembly includes wiring guides to facilitate the organized routing of the cables and cable strain relief.

The overall dimensions of the assembled cabinet are roughly 10 inches high by 9 inches wide by 3.5 inches deep.

## What is Included?

The AT&T IPC-1600 Ports Cabinet kit (COMCODE 405977646) includes the following:

- One AT&T IPC-1600 Ports Cabinet (COMCODE 405977646)
- User documentation
- Standard insert material:
  - Service Information Card
  - Product Registration Card
  - Warranty Card
  - Read-Notice Card—Multilingual Card.

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# Installation Information

**Comment:** Before doing any installation activity, you should first read through all the information in this section to gain a complete understanding of what needs to be done.

## General Instructions

The general sequence to install the IPC-1600 ports cabinet is as follows.

- Step 1: Decide where and how to mount the cabinet.
- Step 2: Secure the wire-frame assembly to a stable surface (optional).
- Step 3: Route the two 80-conductor ribbon cables behind the wire-frame assembly and out through the front of the appropriate 16-Port Fanout module mounting position. Use the upper mounting position first. Each ribbon cable “lead 1” identifier should be on the left as viewed in Figure C-2.
- Step 4: Connect the two 80-conductor ribbon cables to the 16-Ports Fanout module. Make sure that the retaining clips are properly secured.
- Step 5: Install the 16-Ports Fanout module in the wire-frame assembly.
- Step 6: Connect the modular cables to the 16-Ports Fanout module and route the cables in the wiring guides (Figure C-2).
- Step 7: Label (identify) the modular cables.
- Step 8: Snap the cabinet enclosure on to the wire-frame assembly.

The following paragraphs address elements of these major steps.

## Choosing a Mounting Location

The AT&T IPC-1600 Ports Cabinet must be located within about 7 cable feet (2 meters), the length of the fanout module cable assembly, of the host machine.

The method of mounting (floor, table, or wall) is a matter of convenience for your particular installation. The most physically secure method of mounting the cabinet is to fasten it to a stable surface. Secure-type mounting is recommended to protect the connections and apparatus.

## Securing the Wire-Frame Assembly

The wire-frame assembly can be placed, unsecured, on the floor or table. However, it is recommended that the assembly be fastened to a stable surface to provide a physically secure installation.

When securing the wire-frame assembly to a stable surface, make sure of the proper placement of the assembly in relation to the host system.

## Routing and Connecting Ribbon Cables to the Fanout Module

The ribbon cables are routed behind the wire-frame assembly with the “lead 1” identifiers on the left as viewed in Figure C-2. It is recommended that the upper position of the two mounting positions be used first to facilitate easy addition of the second 16-Ports Fanout module.

The connectors on the 16-Ports Fanout module and the ribbon cables are keyed for proper alignment. When connecting the ribbon cables to the 16-Ports Fanout module, be sure that the retaining clips are properly secured.

First, connect the ribbon cable nearest the front of the wire-frame assembly to the 16-Ports Fanout module connector for ports 9 through 16. Then connect the other ribbon cable for ports 1 through 8.

## Installing the 16-Ports Fanout Module

It is recommended that the upper position of the two mounting positions be used first to facilitate easy addition of the second 16-Ports Fanout module.

The 16-Ports Fanout module snaps into the wire-frame assembly from the front of the assembly (Figure C-2). First put the slot on the left side of the 16-Ports Fanout module over the wire tab on the left side of the wire-frame assembly. Then slide the right side of the 16-Ports Fanout module into the wire-frame assembly until the two slots on the right of the module engage the wire tabs.

## Connecting Port Modular Cables

When connecting the modular cables to the 16-Ports Fanout module, it is important to label (identify) the circuit(s). The label information should include the port identification (ttxyyy) and the connecting device identification. After the modular cables are properly labeled (identified), connect each cable to the corresponding port and route the cable through the wiring guides. Be sure to connect the ground lead of the modular cable to the ground lug on the 16-Ports Fanout module.

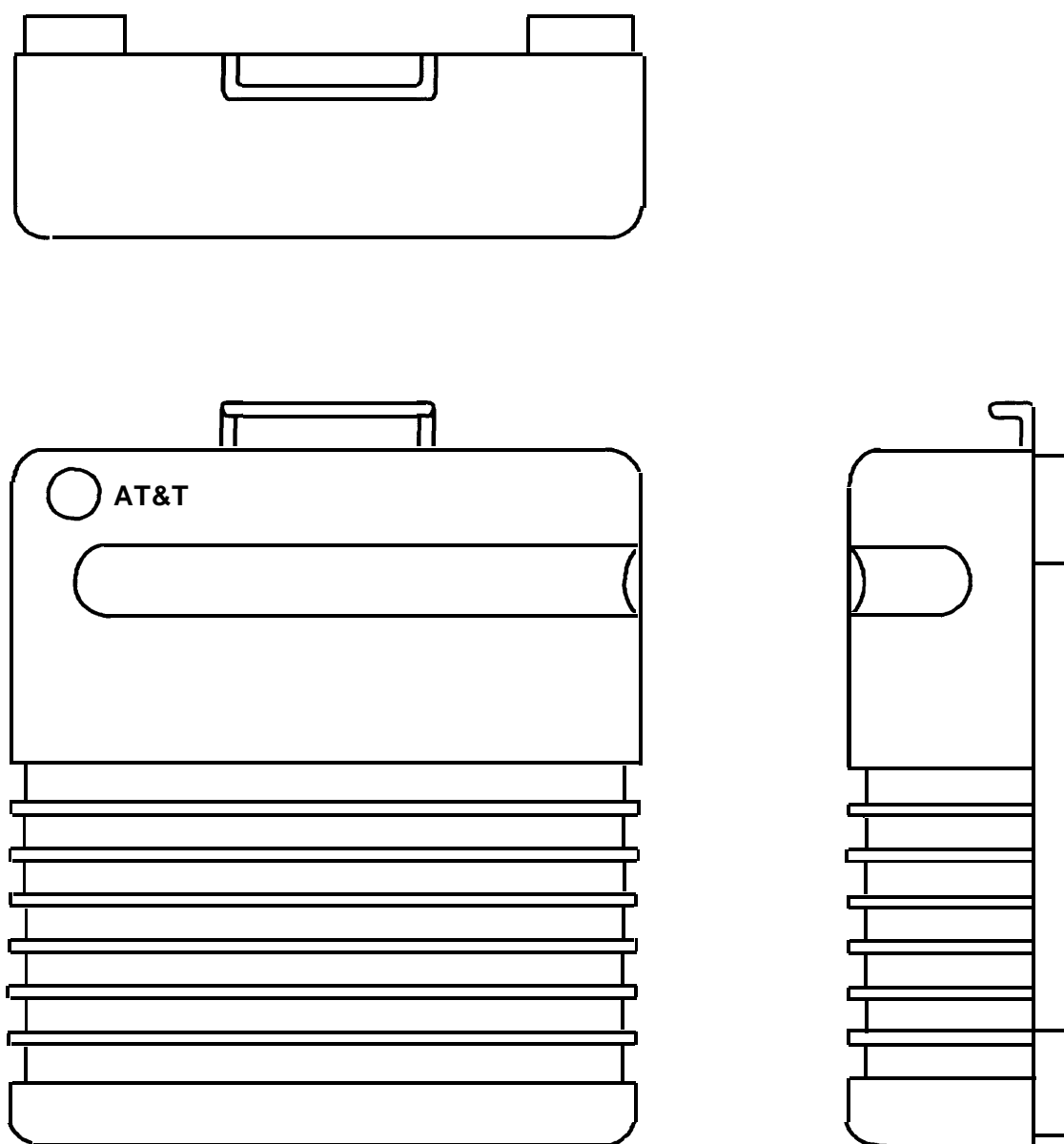


Figure C-1: AT&T IPC-1600 Ports Cabinet

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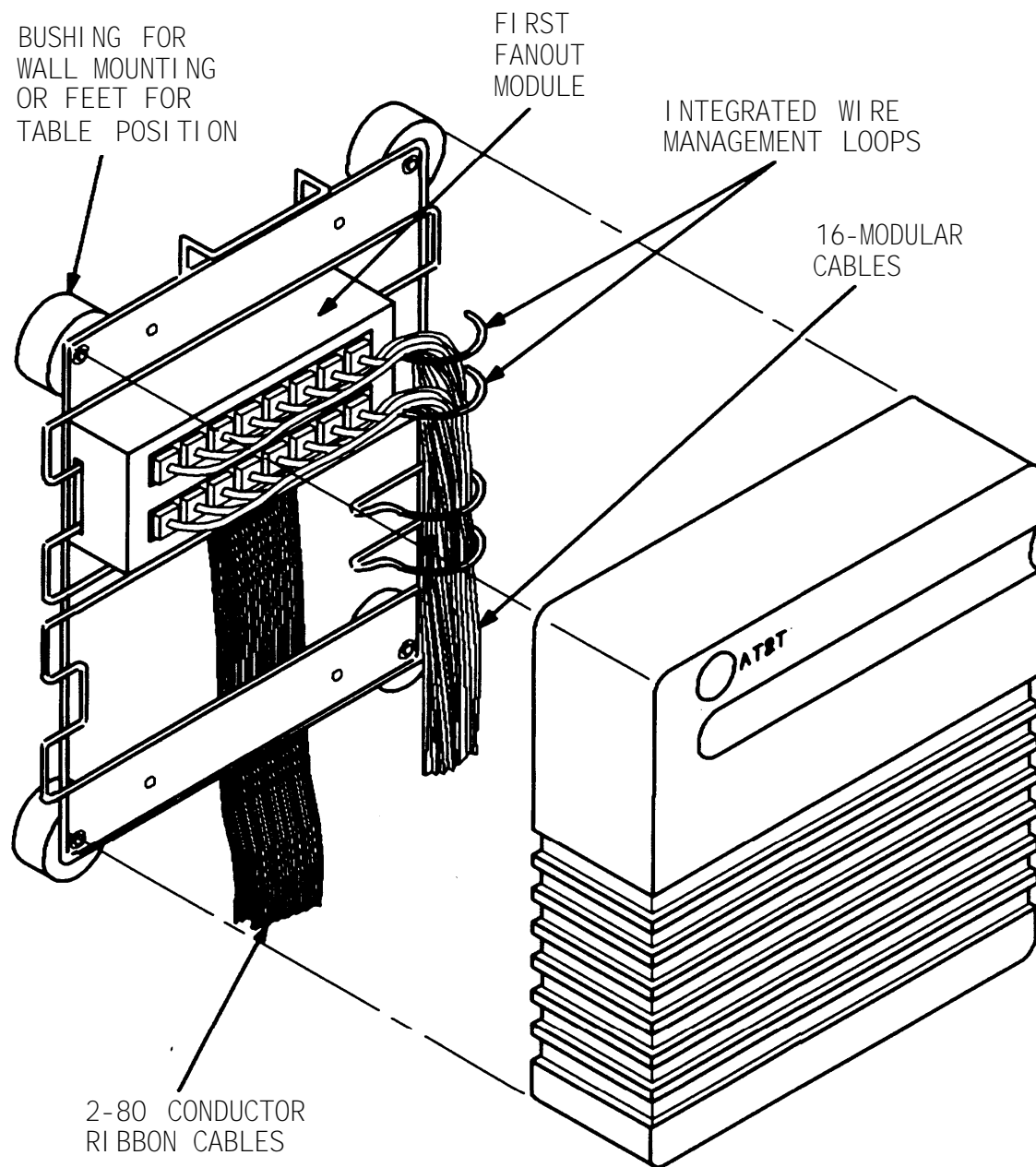


Figure C-2: AT&T IPC-1600 Ports Cabinet Assembly Drawing

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# Glossary

<b>ACU</b>	An Automatic Calling Unit is a device used to make calls (dial) on a telephone network.
<b>address</b>	A number, label, or name that indicates the location of information in the computer's <i>memory</i> .
<b>ASCII Code</b>	American Standard Code for Information Interchange—An 8-bit code that is used when transmitting data between computers or between a computer and a terminal.
<b>BIOS</b>	Basic Input/Output System provides a standardized software/device communications interface.
<b>boot</b>	To start the operating system, so called because the <i>kernel</i> must bootstrap itself from secondary storage into an empty machine. No <i>login</i> [3] or process persists across a boot.
<b>boot block</b>	The first block of a <i>file system</i> [1], which is reserved for a booting program.
<b>boot program</b>	Loads the <i>operating system</i> into core.
<b>buffer</b>	<ol style="list-style-type: none"><li>1. A staging area for input/output where arbitrary-length transactions are collected into convenient units for system operations; the <i>file system</i> [3] uses buffers, as does <i>stdio</i>.</li><li>2. To use buffers.</li></ol>
<b>character device</b>	A <i>device</i> upon which a <i>file system</i> [1] cannot be mounted, such as a terminal or the <i>null device</i> .
<b>configuration</b>	The arrangement of the software or hardware of a system, peripheral, or network as defined by the nature, number, and chief characteristics of its functional units.
<b>controller</b>	A <i>device</i> that directs the transmission of data over the data links of a network.



<b>DCE</b>	Data Circuit-terminating Equipment or Data Communication Equipment is equipment which converts Data Terminal Equipment ( <i>DTE</i> ) binary serial data to be used by a communications facility. DCE is common carrier equipment such as MODEMS, electronic switches, and computers.
<b>device</b>	<ol style="list-style-type: none"><li>1. A <i>file</i> [2] that is not a plain file or a <i>directory</i>, such as a tape drive or the <i>null device</i>; a special file.</li><li>2. A physical input/output unit.</li></ol>
<b>diagnostic</b>	A message printed at your terminal that identifies and isolates <i>program</i> errors.
<b>DIP</b>	See “Dual In-line Package.”
<b>directory</b>	A <i>file</i> that comprises a catalog of <i>filenames</i> [2]; the organizing principle of the <i>file system</i> [2], a directory consists of entries which specify further <i>files</i> (sense 2, including directories), and constitutes a node of the <i>directory tree</i> .
<b>directory entry, entry</b>	<ol style="list-style-type: none"><li>1. An association of a name with an i-node number appearing as an element of a <i>directory</i>.</li><li>2. The name part of such an association.</li></ol>
<b>directory hierarchy</b>	The tree of all <i>directories</i> , in which each is reachable from the <i>root</i> via a chain of subdirectories.
<b>directory tree</b>	Same as <i>directory hierarchy</i> .
<b>disk</b>	A platter coated with magnetic material on which data can be stored.
<b>diskette</b>	A magnetic storage medium which is smaller and more flexible than a hard <i>disk</i> .
<b>DTE</b>	Data Terminal Equipment is equipment comprising the data source, data sink, or both data source and sink that provides for the communication control function (protocol). For

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	example, any equipment at which a communication path begins or ends such as printers, data terminals, and computers.
<b>Dual In-line Package</b>	A device on which an integrated circuit or other small components are mounted. It provides a protective casing for the components and pin connections for plugging the chip in a circuit board.
<b>Dual In-line Package switch(es)</b>	Small switches used to set up or adjust equipment.
<b>DUART</b>	Dual Universal Asynchronous Receiver-Transmitter is a device which provides two RS-232C input/output interfaces (channels).
<b>environment</b>	<ol style="list-style-type: none"><li>1. A set of strings, distinct from the arguments, made available to a process when it <i>executes</i> [1] a <i>file</i>; the environment is usually inherited across <i>exec</i>(2) operations.</li><li>2. A specific <i>environment</i> [2] maintained by the <i>shell</i>.</li><li>3. A nebulously identified way of doing things, as in “interactive environment”: a deprecated usage, not always expunged from these manuals.</li></ol>
<b>error</b>	Occurs when a hardware or software condition prevents the successful execution of a system or a user process.
<b>error message</b>	A message sent from the system to the system console when an <i>error</i> occurs.

<b>execute</b>	<ol style="list-style-type: none"><li>1. Informally, to run a <i>program</i>.</li><li>2. To replace the text segment and data segments of a <i>process</i> with a given <i>program</i> [1].</li></ol>
<b>FEP</b>	The Front End Processor is the IPC-1600 central processing unit.
<b>FEPOS</b>	The Front End Processor Operating System is the downloaded program running in the IPC-1600.
<b>FIFO</b>	A named permanent <i>pipe</i> (First-In-First-Out) which allows two unrelated processes to exchange information using a pipe connection.
<b>file</b>	<ol style="list-style-type: none"><li>1. In general, a potential source of input or destination for output.</li><li>2. Most specifically, an i-node and/or associated contents, i.e., a plain file, a special file, or a <i>directory</i>.</li><li>3. A <i>directory entry</i>; several directory entries may name the same file [2].</li><li>4. Most loosely, a plain file.</li></ol>
<b>file descriptor</b>	A conventional integer quantity that designates an open file.
<b>filename</b>	<ol style="list-style-type: none"><li>1. A path name.</li><li>2. The last component name in a path name.</li></ol>

<b>file system</b>	<ol style="list-style-type: none"><li>1. A collection of <i>files</i> that can be mounted on a block special file; each file of a file system appears exactly once in the i-list of the file system and is accessible via some path from the <i>root</i> directory of the file system.</li><li>2. The collection of all <i>files</i> on a computer.</li><li>3. The part of the <i>kernel</i> that deals with <i>file systems</i> [1].</li></ol>
<b>getty</b>	One of a series of processes which connect the user to the UNIX system. <i>getty</i> is invoked by <i>init</i> and, in turn, invokes <i>login</i> .
<b>init</b>	A general process spawner which is invoked as the last step in the <i>boot</i> procedure; it regularly checks a table that defines what processes should run at what run level.
<b>interrupt</b>	<ol style="list-style-type: none"><li>1. A signal that normally terminates a process, caused by a break or an interrupt character.</li><li>2. A signal generated by a hardware condition or a peripheral device.</li><li>3. Loosely, any <i>signal</i>.</li></ol>
<b>kernel</b>	The UNIX system proper; resident code that implements the system calls.
<b>line discipline</b>	A module to handle protocol or data conversion for a stream. A line discipline, unlike a filter, is part of the <i>kernel</i> .
<b>login</b>	<ol style="list-style-type: none"><li>1. The <i>program</i> that controls logging in.</li><li>2. The act of logging in.</li><li>3. By extension, the computing session that follows a <i>login</i> [2].</li></ol>

<b>memory</b>	<ol style="list-style-type: none"><li>1. Same as memory image.</li><li>2. Physical memory represents the available space in main memory; <i>programs</i> are either swapped or paged into physical memory for execution.</li><li>3. Virtual memory management techniques permit programs to treat <i>disk</i> storage as an extension of main memory.</li></ol>
<b>null device</b>	A <i>device</i> [1] that always yields end of file on reading and discards all data on writing.
<b>operating system</b>	The program for managing the resources of the computer. It takes care of such things as input/output procedures, process scheduling, and the file system (removing this burden from user programs).
<b>pipe</b>	A direct stream connection between processes, whereby data written on an open file in one process becomes available for reading in another.
<b>pipeline</b>	A sequence of programs connected by <i>pipes</i> .
<b>ports</b>	The point of physical connection between a peripheral <i>device</i> (such as a terminal or a printer) and the device <i>controller</i> (ports board), which is part of the computer hardware.
<b>program</b>	<ol style="list-style-type: none"><li>1. An executable file.</li><li>2. A process.</li><li>3. All the usual meanings.</li></ol>
<b>raw device</b>	A block device, read and write operations to which are not buffered and are synchronized to natural records of the physical <i>device</i> .
<b>reboot</b>	Same as <i>boot</i> .

<b>root</b>	<ol style="list-style-type: none"><li>1. A distinguished directory that constitutes the origin of the <i>directory hierarchy</i> in a <i>file system</i> [1].</li><li>2. Specifically, the origin for the <i>file system</i> [2] with the conventional path name slash (/).</li><li>3. The origin of the <i>directory hierarchy</i> in a <i>file system</i> [1].</li><li>4. The <i>super user</i> login.</li></ol>
<b>RS-232C</b>	An industry standard for asynchronous serial data communications between terminal devices, such as printers, computers, and communications equipment. This standard defines a 25-pin connector and certain signal characteristics for interfacing equipment.
<b>shell</b>	<ol style="list-style-type: none"><li>1. The program <b>sh</b>, which causes other programs to be executed on command; the shell is usually started on a user's behalf when the user logs in.</li><li>2. By analogy, any program started upon logging in.</li></ol>
<b>shell script</b>	An executable <i>file</i> of commands taken as input to the <i>shell</i> .
<b>signal</b>	An exceptional occurrence that causes a process to terminate or divert from the normal flow of control; see <i>interrupt</i> .
<b>single-user</b>	A state of the operating system in which only one user is supported.
<b>special file</b>	An i-node that designates a device, further categorized as either a <b>block special file</b> describing a block device, or a <b>character special file</b> describing a <i>character device</i> .
<b>spool</b>	To collect and serialize output from multiple processes competing for a single output service.

<b>standard error</b>	One of three files described under <i>standard output</i> .
<b>standard input</b>	The second of three files described under <i>standard output</i> .
<b>standard output</b>	Open files, customarily available when a <i>process</i> begins, with <i>file descriptors</i> 0, 1, 2, and <i>stdio</i> names “stdin,” “stdout,” “stderr;” where possible, utilities by default read from the standard input, write on the standard output, and place error comments on the standard error file. Initially, all three of these files default to your terminal.
<b>startup</b>	Same as <i>boot</i> .
<b>super user</b>	User ID 0 (user identification number 0), which can access any <i>file</i> regardless of permissions and can perform certain privileged system calls; for example, setting the clock. The <i>root</i> [3] <i>login</i> name.

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